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V.

A REVISION OF THE BRITISH ACTINIÆ. PART I.

By ALFRED C. HADDON, M.A. (Cantab.), M.R.I.A., Professor of Zoology, Royal College of Science, Dublin.

(Plates XXXI. to XXXVII.)

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[Read June 18, 1888.]

This is the first of what I hope will be a series of communications to the Royal Dublin Society on the Sea Anemones of the British seas. Thanks to the labours of such naturalists as Mr. George Johnston, Professor Edward Forbes, Sir John Dalyell, Mr. R. Q. Couch, and many others, but most especially to those of Mr. P. H. Gosse, we have a very complete knowledge of the appearance and habits of the Actiniæ found round our shores. In scarcely any country is the Actinian fauna so well described and figured as that in our own.

In classifying the Actiniæ external characters were alone formerly considered; but of recent years attention has been drawn to internal structure as a basis for classification. It is to the brothers Hertwig that the credit of the new departure is mainly due, and more particularly to Dr. Richard Hertwig, who, in his masterly "Report on the Actiniaria" dredged by H. M. S. "Challenger," has laid down broad lines of Actinian taxonomy, which, being based on morphology, are more strictly scientific than the systems of Prof. H. Milne Edwards, Mr. Gosse, Prof. Verrill, or Dr. Andres.

The time has now arrived when it is advisable and possible to revise the British Actiniæ. Not a few of the genera and species found around the coasts of Europe have been described from British specimens; but, apart from external characters, we are unable to assign to most of them a position in the groups proposed by Prof. R. Hertwig, on account of the absence of any knowledge of their anatomy. It is to take away this reproach that I have attempted a revision of the British Actiniæ, of which the present is a first contribution.

Considerable confusion has unnecessarily been made in the synonymy of the Actiniæ, owing to the generally recognised rules of zoological nomenclature being too often ignored. In the course of this revision I have found it necessary to adopt several generic and specific names, which have been rarely used by zoologists, in the place of very well-known names—for example, *Tealia crassicornis* (O. F. Müll.) becomes *Urticina felina* (Linn.), and *Sagartia* (*Heliactis*) *bellis* (Ellis and Sol.) must be known as *Cereus pedunculatus* (Penn). I have done this with great reluctance, as it is not easy to remember the scientific names of animals when they are being continually changed; and, further, superfluous change in nomenclature is very objectionable from a faunistic and museum point of view; the latter, however, need hardly be considered in the present instance, as few museums possess any Actiniæ at all.

Not only has simple priority been ignored, but new names have sometimes been given, even when the introducer of the new name was aware of the pre-existing names.

In a few instances an old name has been misapplied to a species when the recorder had no knowledge that it was the same species. This error has occasionally been fallen into because the published description of the older naturalists were usually somewhat vague, so that the description might very well apply to more than one species. It is only by the recovery of the lost type and its re-description that such unavoidable errors can be rectified. But again, confusion is made when a zoologist assumes, without sufficient proof, that his specimen, possibly only known in the preserved state, is the same species as that previously described from living forms, captured, perhaps, thousands of miles distant. This action, instead of having the desired effect of simplifying classification, adds to its confusion, as it is always much easier to unite species together than to split up a species. If any doubt exists it is far better to describe the species as new, and to leave its amalgamation with previously described species to one who has a personal knowledge of that species, than to beg the question, and, by assuming an identity, to run the risk of giving false anatomical characters to an old species.

When an author has diagnosed a new genus, and named a species as its type, these names should thenceforth be inseparably connected, unless priority has been infringed. It is the ignoring of this recognised rule which has largely complicated Actinian nomenclature.

For the mere naming of specimens, a trained eye, an acquaintance with the bibliography, and an appreciation of the rules for zoological nomenclature, are alone necessary. For the classification of the genera and species it is requisite to have a fairly minute knowledge of their anatomy. Mere reliance upon outward form or external characters has led to essentially dissimilar forms being associated together. A rational scheme of classification must also take the development of the individual into account. Thus, while the name of an animal may be determined by the collector or museum curator, these must accept the classification suggested by the comparative anatomist and embryologist. Once the taxonomy is established, the most easily ascertained characters, even if they are of trivial importance, are all that are necessary for determining purposes. The separation of the methods of systematic zoologists and those of structural zoologists has been the fruitful cause of complication in nomenclature.

In the following descriptions I have to classify the Actiniæ referred to from an anatomical standpoint; but, at the same time, external characters of both living and preserved specimens have not been ignored. Preserved Actiniæ are peculiarly difficult to determine: with increased knowledge a great deal may be done, but in many cases the task will probably always remain hopeless, unless notes on form and colour have been taken of the living animal.

In the following pages it will be seen that the species of the genera Edwardsia and Halcampa, which have already been examined, can readily be distinguished by certain anatomical details, as, for instance, the pattern of the longitudinal retractor muscles of their mesenteries. On the other hand, the three species of the genus Sagartia, *s.s.*—*S. miniata*, *S. venusta*, and *S. nivea*, cannot at present be distinguished anatomically. A possible explanation is not far to seek. From their general structure we may confidently assert that Edwardsia and Halcampa are old genera, as they retain, in their adult state, features which are transiently present in the young of the more typical Actiniæ. We may therefore assume that the existing species of this genera are well established, and have remained constant for a sufficient period for the acquisition of definite structural characters. The genus Sagartia is more specialized, and it is open to us to suppose that the species have not yet got beyond the stage of colour differentiation.

Parallel cases can be found in almost every group of animals where the species of one genus are easily defined, whereas in another genus the specific distinctions have reference to the presence or absence of a particular spot or marking.

In order to establish actinological studies on a sure foundation it will be necessary first of all to recover the types. The most satisfactory way to accomplish this is to go to the original locality and collect specimens there. Then, having recovered it, the type must be subjected to anatomical investigation. Its place in the system of Actiniæ will then be accurately known, and not till then. There has been up to the present a great deal too much of guess-work in this group.

I have found it necessary to introduce a few new terms, in order to indicate certain mesenteries and the chambers between them. In adult forms an axial line is always recognisable, but beyond that, in the majority of Actiniæ there is a radial symmetry. It has long been known that the larval forms of all Actiniæ hitherto studied are bilaterally and not radially symmetrical, and a definite orientation is possible for these, and for some adults, as I shall subsequently show. The new terms I propose have relation to this primitive bilateral symmetry.

I have shown elsewhere (**1887**, p. 473*) that the larval Halcampa possesses a single deep œsophageal groove. I have reason to believe that the remarkable groove in Peachia occurs at the same angle of the œsophagus in that genus. The single œsophageal groove of the Zoantheæ has the same relations. I therefore take this as the more important groove, and speak of it as the "sulcus:" the less important opposite groove is the "sulculus."

The sagittal œsophageal grooves were named by Mr. Gosse the "gonidial grooves" (*canales gonidiales*) (**1860**, p. 4). He did not distinguish between them. Dr. Andres (**1884**, p. 73) adopts the terms *gonidium* and *gonidulum*. It may be considered that it is unnecessary to coin new terms with these before us; but they do not readily lend themselves to combination with others. The brothers Hertwig distinguished these grooves as "dorsal" and "ventral." This is an unfortunate application of terms which have a false significance in our group. We may speak of organs as "lateral" to a given axial line, but the words "dorsal" and "ventral" have no meaning, except a misleading one, for the Actiniæ. The sulcar directive mesenteries correspond with the "ventral" of the German authors, and the sulcular with the dorsal. Dr. Hickson (**1883**, p. 693) has introduced the term "siphonoglyphe" for the ciliated axial groove of Alcyonarians, in which group it is now universally accepted. It is, however, not conveniently applicable to the Actiniæ. The terms "axial" and "abaxial," as used by Prof. A. Milnes Marshall (**1883**, p. 125), for Pennatula, have express relation to the axis of the polypdom, as Dr. Marshall speaks of the "inner or axial," and the "outer or abaxial," surfaces. These terms are clearly unsuitable for Actiniæ.

In adult Actiniæ with two œsophageal grooves it is not possible to distinguish which is the sulcar and which is the sulcular groove; nor when only one groove is present can we in all cases determine which it is. Probably it will be found that, in every case where one groove only is present during the whole of life, it is the sulcar groove. But in the case of the genus Sagartia (Gosse, *s. s.*), one groove is as often present as two. There is no reason, as far as is known, to regard this as the sulcus. It appears to be more probable that the one-grooved condition is a secondary feature, and the groove may be either the sulcus or the sulculus. When it is impossible to determine the homology of the groove or grooves, I shall simply term them œsophageal grooves.

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* In referring to the bibliography which is appended to this Revision, I have adopted the plan introduced by Dr. E. L. Mark, of Harvard, by which the reference number gives the reader the approximate date of the article.

In addition to the sagittal grooves lateral furrows may or may not be present; they are of no morphological importance.

The whole endodermal cavity has been appropriately termed the cœlenteron; it is divided radially by the mesenteries into chambers. I have adopted Mr. Fowler's (**1885**, p. 578) terms of "endocœle" for an intra-mesenterial chamber, and "exocœle" for an inter-mesenterial chamber. The endocœles of the directive mesenteries are respectively the sulcar endocœle and the sulcular endocœle. The combinations used to designate the various chambers of the ground-type are given in the last section of this communication.

The use of the term "septa" instead of "mesenteries" for the radial partitions of the cœlenteron is to be strongly deprecated, owing to the universal acceptance of that word for the radial calcareous plates of the Madreporaria.

Mr. Bourne's (**1887**, p. 311) term, "mesoglœa," bids fair to be generally adopted. It conveniently replaces the term "mesoderm," which is open to serious objection, and such cumbersome names as "supporting membrane" or the like.

A word of personal explanation is necessary. I had hoped to be able to deal with the subject in something approaching to a logical method; but two circumstances have prevented this: the first is the difficulty which exists in procuring specimens of many of the species. If completed work on available specimens was retarded in publication until other species or genera were obtained, the results attained would long lie dormant. In the second place, I am leaving Ireland for some time, and it may be a considerable period before I shall be able to conclude this series of Papers. I shall not even have the opportunity of reading the proofs of this Memoir. Thus, at present, I am only in a position to give an approximately complete account of one group of the Actiniæ—the Chondractininæ; in another section of this Paper I deal with a variety of genera, all of which, however, may be regarded as more or less representing the various stages in the evolution of the typical hexameral Actiniæ.

The family Sagartidæ was first thus defined by Mr. Gosse (**1858**, p. 415): "Sagartiadæ [this is the form of spelling adopted, and adhered to, by Mr. Gosse]. Basis adhærens. Tentacula simplicia, in cyclis continuis digesta. Cutis, pro filis retractilibus armatis emittendis, perforata." It included the genera Actinoloba (*A. dianthus*) and Sagartia, the latter being thus diagnosed: "Basis integra, cyclica. Tentacula libenter et totaliter retractilia. Cutis acetabulis instructa. Os duabis canalibus gonidialibus instructum" with the following species: *S. bellis*, *S. miniata*, *S. rosea*, *S. ornata*, *S. ichthyostoma*, *S. venusta*, *S. nivea*, *S. sphyrodeta*, *S. pallida*, *S. pellucida*, *S. coccinea*, *S. troglodytes*, *S. viduata*, *S. parasitica*. Although the title-page of the "Actinologia Britannica" bears the date of 1860, the book was issued in bi-monthly parts, of which the first (pp. 1–32) was issued, as dated, on March 1st, 1858; consequently the fuller diagnosis, in English, of the family Sagartiadæ is practically synchronous with the former. Five British genera are recognized, viz.: Actinoloba, Sagartia, Phellia, Adamsia, and Gregoria. The foreign genus, Discosoma, is also added to this family. The species of Sagartia are treated in the above order. On p. 122 of his monograph (published Sept. 1, 1858), Mr. Gosse remarks: "The species already described appear to me to be divisible into four or five groups . . . The most typical group, and that for which, should the genus be broken up, I would retain the name Sagartia, includes the following species:—*miniata*, *rosea*, *ornata*, *ichthyostoma*, *coccinea*, *venusta*, *nivea* . . . A group rather less typical than this, I consider to be formed by the following species:—*sphyrodeta*, *pallida*, *pura* . . . Should a generic name ever be required for this group, I propose for it that of Thoe: *troglodytes*, *viduata*, and *parasitica* may be associated as a group departing still more widely from the typical form . . . In the event of redistribution, this group might receive the name of Cylista: *bellis* will probably be considered by many as worthy of generic separation . . . It might be called Scyphia. About the same date Mr. Wm. Thompson (**1858**), being struck by the peculiar characters of *S. bellis*, created for it the genus Heliactis. Both Messrs. Gosse and Thompson overlooked the fact that Dr. Oken (**1815**, p. 349) erected the genus Cereus, constituting *C. bellis* as its type. Profs. Milne Edwards (**1857**, p. 269) and Verrill (**1869**, p. 480), and M. Fischer (**1874**, p. 211), appear to be the only authors who have recognized Oken's priority; although the first does not actually allude to Oken. Again, M. Fischer correctly restores Mr. Pennant's (**1776**) specific name, *pedunculatus* (not "*pedoriculatus*," as M. Fischer spells it), instead of the more commonly adopted *bellis* of Ellis and Solander (**1786**).

From the foregoing abstract it will be perfectly evident that Mr. Gosse regarded *S. miniata* as the type species of his genus Sagartia. For the future these two names must remain inseparable.

Mr. Gosse makes the possession of two œsophageal grooves one of the characters of the genus, and they are certainly very commonly present amongst the Sagartidæ. Mr. G. Y. Dixon has, however, very recently shown (**1888**, p. 120) that one œsophageal groove only is as frequently found as two in both *S. miniata* and *S. venusta*. Of this I have also satisfied myself. My friend and pupil, Mr. Francis Dixon, is at present investigating the anatomy of these and allied species, and he has found (**1888**) that only one pair of directive mesenteries are present in those forms in which the single œsophageal groove occurs, and that in adult specimens the number of paired mesenteries does not appear to bear a direct ratio to the number six. In all cases, amongst adults, more than six pairs of perfect mesenteries are present.

I find that in a specimen of *Cereus pedunculatus* (*Sagartia bellis*, Auct.), of which I have a series of sections, there are two œsophageal grooves and two pairs of directives: the first two cycles of mesenteries (*i. e.* twelve pairs) are perfect, and in addition an irregular number of the other mesenteries may also reach the œsophagus. The same occurs in *Cylista viduata;* but in *Cylista undata* (*Sagartia troglodytes*) no more than twelve pairs of primary mesenteries, including two pairs of directives, join the œsophagus in the single specimen of which I have sections (M. Fischer (**1874**) regards *C. troglodytes* as a variety of *C. viduata*). In *Gephyra dohrnii* the second cycle of mesenteries extends to the greater portion of the œsophagus, if not to its whole length. Here again two œsophageal grooves and two pairs of directive mesenteries are present in the specimens I have investigated.

Prof. Verrill (**1869**, p. 477) accepts Mr. Gosse's group, but regards the "Sagartinæ" as a sub-family of the Actinidæ (see also Verrill, **1864**, p. 21—Proc. Essex Inst., v. 1868, p. 322—*ibid.* VI. 1869), including within it Metridium, Oken (type *M. dianthus*); Cereus, Oken (type *C. bellis* (*pedunculatus*); Calliactis, Verrill, gen. nov. (type *C. decorata*, Drayton sp.); and Sagartia. Concerning this genus Prof. Verrill says (*l. c.* p. 483): "It seems necessary to restrict this genus to the group considered typical by Gosse, with which the rather less typical group, to which he gives the subgeneric name *Thoe*, and some other forms may also be united; Nemactis (type *N. primula*—Drayton, sp.)

Dr. Andres (**1884**, pp. 130–132) includes Actinoloba, Heliactis, Cylista, Adamsia, Aiptasia, Sagartia, and Nemactis in the Sagartidæ, thus excluding the genera Phellia and Gregoria. Nothing can be said about the latter until it has been re-discovered; it was described from a single, possibly immature, specimen. In addition to Nemactis, which Prof. Verril had previously recognized as belonging to this group, Dr. Andres adds Aiptasia (type *A. couchii*—Gosse).

Prof. R. Hertwig (**1882**), in his most valuable Report, says:—"I have followed Gosse as far as possible in fixing the limits of the families, but my great endeavour has been to define more sharply the meaningless characteristics hitherto in use, by bringing more emphatically forward the anatomical characteristics predominantly developed in the separate families, such, for example, as the nature of the septa [mesenteries], and of the circular muscle, the presence of secondary tentacles and acontia (the latter may appropriately replace the cinclides), and the distribution of the reproductive organs. Thus I have characterized the family of the Sagartidæ afresh, as I have laid down as essential that they should possess acontia and a mesodermal circular muscle, and that the six pairs of principal septa [mesenteries] should be distinguished from the rest by being alone perfect, and not bearing reproductive organs. I found these conditions in a whole series of forms belonging to the Sagartiæ; and if other species hitherto placed among them do not agree in these respects, it is impossible that they should remain in one and the same family" (p. 18).

The family Sagartidæ is succinctly defined (p. 70). The presence of acontia and of but six pairs of perfect and at the same time sterile mesenteries is made of prime importance. The brothers Hertwig first observed these facts in *Adamsia diaphana*, *Metridium dianthus*, and *Calliactis* (*Sagartia*) *parasitica*. The same occurred in five different species of the "Challenger" material, viz. *Sagartia*, sp. (p. 72), *Calliactis polypus* (Forsk.) (p. 74), *Cereus spinosus*, n. sp. (p. 76), *Phellia pectinata*, n. sp. (p. 81), *Bunodes minuta*, n. sp. (p. 84).

Prof. Hertwig evidently had some misgiving in including the genus Bunodes amongst the Sagartidæ. On page 84 *l. c.* he says: "Among the 'Challenger' material I found one true representative of the Sagartidæ, the external appearance of which justified its being placed in the genus Bunodes. I have determined it as *Bunodes minuta*, as I consider it quite possible that the acontia have hitherto been overlooked in the species of the genus Bunodes. If this view be erroneous it would be necessary to erect a new genus for *Bunodes minuta* and *Bunodes coronata*." It has evidently escaped Prof. Hertwig's notice that M. Fischer had already, in 1874, proposed a new genus, Chitonactis, for the reception of *Bunodes coronata*, Gosse. These two species will be referred to later on.

It is unfortunate that Dr. Hertwig has laid down the law so strongly as he has, as he leaves himself no loophole for escape. We have just seen that *Sagartia miniata*, Gosse (**1853**) (perhaps it should more correctly be designated *S. elegans* (Dal.) (Sir J. Dalyell—**1848**, p. 225, pl. xlvii., figs. 9–11), is the type species of the genus, *S. venusta* being a closely allied species. As previously stated, Mr. Francis Dixon's discovery concerning the irregular occurrence of the mesenteries precludes the drawing of a hard-and-fast line, as has been done by Prof. Hertwig. If we follow this anatomist we shall be landed in the difficulty of excluding the genus Sagartia from the family Sagartidæ!

It appears to me that we have not at present sufficient facts to be able to satisfactorily classify many of the Sagartians. By the latter term I include all those Actiniæ which possess acontia. There is, however, a natural group amongst them which, for the present, I will assume has the value of a sub-family, and which I propose to term the "Chondractininæ."

Chondractininæ.—New sub-family of Sagartian Actiniæ, with the lower portion of the column more or less rigid, upper portion (capitulum) usually different in character from the lower (scapus), and capable of being entirely invected; strong mesodermal circular muscle; numerous contractile tentacles; the primary mesenteries, consisting of two pairs of directives and four pairs of ordinary mesenteries, only are perfect and at the same time are sterile; a cuticle is always more or less developed, except upon the capitulum; warts or nodules are generally present; the acontia, which always occur, are rarely emitted, and then by the mouth only.

It will be seen that this definition is almost the equivalent of that of Prof.

Hertwig's family Sagartidæ, but for the reasons given above this family cannot stand. The proposed sub-family is more extensive than the sub-families Phellinæ of Prof. Verrill, or Phellidæ of Dr. Andres. Although Phellia is probably allied to this group of Actiniæ, I have considered it wiser to propose a new name, partly because we have not sufficient anatomical investigation on Phellia, and partly on account of the more extended range which I desire to give to this sub-division, the older terms being subject to misapprehension.

CHONDRACTININÆ.

CHONDRACTINIA,	Lütken,	Type	*C. digitata* (O. F. Müller).
HORMATHIA,	Gosse,	,,	*H. margaritæ*, Gosse.
CHITONACTIS,	Fischer,	,,	*C. coronata* (Gosse).
ACTINAUGE,	Verrill,	,,	*A. richardi* (Marion).
PARAPHELLIA,	n. g.,	,,	*P. expansa*, Haddon.

CHONDRACTINIA, Lütken, 1860.

Chondractininæ with thick mesoglœa which prevents the body from being much contracted; circular muscle very large; capitulum smooth (usually); summit of scapus surmounted by twelve tubercles (coronal tubercles); scapus more or less warty or nodular; cuticle feebly or strongly developed.

The genus Chondractinia was established by Dr. Lütken (**1860**, p. 190), for *Actinia digitata*, Müller, and *A. nodosa*, Fabr., but without any definition. The name appears to have entirely lapsed, and has only twice since been used—in 1875, by Dr. Lütken, and by Canon Norman in the following year in referring to *C. nodosa*. The genus is very close to Hormathia, Gosse, and they may possibly be merged in future.

Mr. Gosse included *A. digitata*, Müller, in the genus Tealia, which latter he had proposed for *Urticina felina* (*A. crassicornis*, Muller). As this was done without a personal knowledge of the species, but merely from the drawings and description of Mr. Joshua Alder, we may assume that he would have acquiesced in their generic distinctness had he then been acquainted with it. Urticina has priority for the generic name of *A. felina*, Linn. It is open to us either to keep Tealia for

A. digitata, or to drop that generic title altogether, and adopt instead the slightly later, Chondractinia of Dr. Lütken, although the latter was never strictly defined. The objection to retaining the name Tealia is, that it has always been more particularly associated with its type species *crassicornis*, but the latter belongs to an entirely different family of the Actiniæ from that in which *A. digitata* can be placed.

RECOGNISED SPECIES OF THE GENUS CHONDRACTINIA.

Chondractinia digitata (O. F. Müller).

North European Seas.

Chondractinia nodosa (Fabricius).

This is not, however, the *Actinauge* (*Urticina*) *nodosa* of Prof. Verrill.
Greenland Seas.

Chondractinia digitata (O. F. Müller).

(Plates XXXII., figs. 7–10; XXXIII., figs. 11, 12; XXXV., figs. 5–7.)

Actinia digitata, n. sp., O. F. Müller, .	1776, Zool. dan. prodr., No. 2796.
Actinia digitata, O. F. Müller, . .	1806, Zool. dan., v., p. 16, pl. cxxxiii.
Actinia digitata, Sars, . . .	1851, Nyt. Mag. Naturvid. vi., p. 143.
Cereus digitata, Milne Edwards, . .	1857, Hist. Nat. des Cor., i., p. 272.
Tealia digitata, Gosse, . . .	1858, Ann. Mag. Nat. Hist. (3), i., p. 417; and Actin. Brit., p. 206, pl. vi., fig. 10.
Tealia digitata, Norman, . . .	1868, Shetland Report, Brit. Assoc., p. 318.
Urticina digitata, Verrill, . . .	1873, Amer. Jour. Sci., vi., p. 5.
Chondractinia digitata, Lütken, . .	1860, Vidensk. Meddel. Nat. Foren., p. 188.
Tealia digitata, Andres, . . .	1884, Le Attinie, p. 203.

The above are the most important references to this species. A more complete bibliography is given by Prof. Andres. Since the time when Müller described the species, Messrs. Sars, Alder, Gosse, and Lütken, have alone added to our knowledge of it. Dr. Lütken describes it as being "in general white, sometimes pale flesh-coloured, especially above nearest the origin of the tentacles, which also have a faint reddish colour. It is of a firm, cartilaginous consistency, and can change its form very little. Its tolerably smooth base widely spreads to embrace shells of living Buccinum or Tritonium; rugged transverse eminences appear in rows on the base; the sides are also beset with oblong knobs which are arranged fairly regularly; at its upper portion they are suddenly larger, and again decreasing in magnitude, they arrange themselves in twelve rows converging to the mouth. Some examples are, moreover, more tuberculated than others, and in some solitary cases can even be seen almost entirely smooth." Dr. Lütken never saw it "fully expanded, as represented in the 'Zoologia Danica,' but either with entirely withdrawn tentacles, or when only little could be seen."

A good figure of this species has long been a desideratum. Owing to the great kindness and liberality of my veteran friend and colleague, Mr. Gosse, in placing all his drawings and sketches of Actiniæ at my disposal, I am enabled to reproduce two of his beautiful drawings (Pl. XXXII., figs. 7 & 8). The drawing was labelled "*Tealia digitata*, from Mr. Stanger's specimen, del. P. H. G., June 11, 1860." Canon A. M. Norman has, with characteristic generosity, given me two specimens of this species which he dredged from the Shetland Seas in 1863. These I have drawn on Pl. XXXIII., figs. 11 & 12. At the same time he forwarded to me the original drawing of the same species by Mr. Joshua Alder; and although the same drawing was copied in Mr. Gosse's 'Actinologia Britannica' (Pl. VI., fig. 10), I have not considered it superfluous to reproduce it once more. On comparing the two reproductions it will be seen that Mr. Gosse's artist has made the tubercles nearly uniform in size, whereas the coronal tubercles should be large and distinct, as Mr. Gosse quotes from Mr. Alder (*l. c.* p. 206). The capitular tubercles have been rendered too prominent in Mr. Alder's drawing. In neither Mr. Gosse's specimen nor in those I have examined are there any tubercles on the capitulum. It would be ungracious to assume an error of observation on the part of such an accurate observer as the late Mr. Alder, so, for the present, I prefer to leave the presence of small tubercles on the capitulum of this species an open question. Lastly, the colour of the figure in Mr. Gosse's plate agrees neither with Mr. Gosse's own description (*l. c.* p. 206) nor with Mr. Alder's drawing.

From Mr. Gosse's drawing it appears that the colour of this species may be pinkish white and the tentacles violet. With the four coloured figures of living specimens of *C. digitata* (Pl. XXXII.) and the two representations of preserved forms (Pl. XXXIII.) there should now be no difficulty in its identification.

I have submitted half of the specimen drawn in fig. 12, Pl. XXXIII., to an anatomical investigation. A vertical section through the animal (Pl. XXXV., fig. 7) shows the great size of the mesoglœal sphincter or circular muscle (*c. m.*). By transverse sections (Pl. XXXV., figs. 5 & 6) we find that the mesoglœa is relatively very thick. This is especially noticeable in the mesenteries, where it is thicker than in any other Actinian with which I am acquainted: the lacunæ, which are shown in fig. 5, from the irregularity of their appearance, appear to be simply due to some imperfection in the method of preparation. The character of the longitudinal or retractor muscles of the mesenteries is very characteristic (fig. 6). The specimen is a male.

Chondractinia nodosa (Fabr.).

(Plates xxxiii., fig. 13; xxxv., fig. 4.)

Actinia nodosa, n. sp., O. Fabricius, .	1780, Fauna Grönlandica, p. 350.
Actinia nodosa, Gmelin, . . .	1788–93, Syst. Nat. (Linn.), xiii., p. 3133.
Actinoloba nodosa, Blainville, . .	1830, Dict. Sci. Nat., lx., p. 288.
Actinoloba nodosa, Blainville, . .	1834, Manuel d'Actin. et de Zooph., p. 322.
Actinia nodosa, Brandt, . . .	1835, Prod. Descript. Animal, p. 10 (also Ann. Sci. Nat. (2) v., 1836).
Metridium (?) *nodosa*, Milne Edwards,	1857, Hist. Nat. des Cor., &c., i., p. 254.
Chondractinia nodosa, Lütken, . .	1860, Vidensk. Meddel. Nat. Foren. Kjöbenhavn, p. 190.
Actinia nodosa, Möbius, . . .	1873, Jahresb. Com. Untersuch. Deutschen Meere in Kiel., p. 246 (abstr. Ann. Mag. Nat. Hist. (4), xiii., 1874, p. 203.
Chondractinia nodosa, Lütken, . .	1875, Arctic Manual and Instructions, p. 186.
Chondractinia nodosa, Norman, . .	1876, Proc. Roy. Soc., xxv., p. 208.
Actinia nodosa, Andres, . . .	1884, Le Attinie, p. 378.

The typical form of *Urticina* or *Actinauge nodosa* of Prof. Verrill and other American authors is not this species; its identity is discussed further on. It is, however, possible that some of the forms identified under this name may really be this species.

Although this species has not yet occurred within the British marine area, I have deemed it advisable to introduce a description of it for the sake of comparison with *C. digitata*. The accompanying figure (Pl. xxxiii., fig. 13) is the only published drawing of it. For the loan of the specimen from which the drawing was made I am indebted to the kindness of Canon A. M. Norman. The specimen was named by Dr. Lütken, and is therefore authentic. It was obtained from the west coast of Greenland, off Disco Island (lat. 69° 31′ N., long. 56° 1′ W.), from 100 fathoms, July 23, 1875, in the "Valorous" expedition.

Description of a single specimen preserved in alcohol:—Form columnar, thicker above, and expanding below to a large basal disk; wall of body very rigid; capitulum smooth, with an imperfect (?), very thin cuticle; scapus beset with very prominent knobs, many of which have a distinct, nipple-like apex; twelve large coronal tubercles mark the junction of the scapus with the capitulum; most of the other knobs have a more or less distinct vertical arrangement; between these are a few irregularly disposed; the knobs decrease in size inferiorly, and the lower portion of the column and the basal disk are devoid of them; the wall of the scapus is transversely wrinkled, and provided with a thick cuticle. The tentacles are set in several rows, and appear longitudinally wrinkled; the circular muscle is short and thick; the mesoglœa (mesoderm) is very thick and solid. In the preserved specimen the colour of the capitulum is yellowish white, slightly streaked with brown when the cuticle persists; that of the upper portion of the scapus is a deep, rich brown, becoming paler below; the uncovered portion of the knobs is white. Dimensions: total height, 64mm.; diameter of upper portion of column, 33mm.; diameter of lower portion, 24mm.; average expanse of pedal disc, 41 mm.

Since Fabricius, Dr. Lütken (1860) is the only author who has alluded to this species from actual knowledge, and he says very little about it; in fact, since the original, imperfect description, the species has never been properly diagnosed.

A vertical, longitudinal section is given on Pl. xxxv., fig. 4; the most noticeable feature is the great length of the œsophagus. The rigidity of the body is due to the well-developed mesoglœa. The circular muscle in the single specimen examined is short and thick, and marked by several concentric lines.

HORMATHIA, Gosse, 1859.

Chondractininæ with very contractile body wall, pillar-like when extended, smooth or corrugated, not warty, surrounded by a single row of coronal tubercles; capitulum smooth, or with twelve ridges; base expanded; cuticle more or less developed; circular muscle very large; disc slightly concave, scarcely exceeding the column; tentacles moderately long and slender; perfectly retractile.

RECOGNISED SPECIES OF HORMATHIA.

Hormathia margaritæ, Gosse.

North East Scotland, Shetland.

Hormathia pectinata (R. Hertwig).

West Patagonia.

Hormathia andersoni, Haddon.

Mergui Archipelago (Burmah).

With a single exception (F. E. Schulze, 1875, p. 139), the hitherto unique species of this genus has been unrecognized, since Gosse described it from a single specimen. Although no specimen of the type exists, nor drawing of the contracted animal, and though no anatomical investigations have been made upon it, I have no doubt that the specimen on which the genus was founded belongs to this sub-family.

Mr. Gosse was uncertain as to the exact number of the large, well-defined warts below the margin; he says "about ten in number"; we are justified in assuming there were twelve.

Canon Norman gave me a specimen of a Chondractinian from Shetland, which agrees so closely with Mr. Gosse's description, that I have no hesitation in relegating it to this genus, although Mr. Gosse describes a living and expanded form. I have further ventured to allocate my specimen to the described species. I was for a long time undetermined whether to do so or to make it a new species, associated with Canon Norman's name, as I had no proof of the identity of the two specimens in question; but on carefully considering the question, I could not discover any valid reason for separating them. The Shetlands, also, are not very distant from the Moray Firth.

The Shetland specimen is very similar to an Actinian described by Dr. R. Hertwig as *Phellia pectinata*, n. sp. (**1882**, p. 81, pl. i., fig. 7, etc.), from the channel between Wellington Island and Patagonia, Station 307, 147 faths., and to a form which I have recently described as *H. andersoni* (**1888**, p. 251, pl. xx.), from the Mergui Archipelago, off Burmah.

This genus is certainly very closely allied to Dr. Lütken's genus, Chondractinia, which was introduced the following year. The absence of tubercles on the column and its greater contractility appear to be the main distinctions. I should hardly have considered myself justified in supporting the distinctness of the two genera, had I not been personally acquainted with two species of each genus. Further, the European, Burmese, and Patagonian are so closely allied, though good species, that they naturally go together. If, therefore, the genus Chondractinia is merged with Hormathia, the species mentioned in this communication will group themselves into two series, corresponding to those species which I have ranged within the two genera under discussion.

Hormathia margaritæ (Gosse).

(Plates XXXIII., fig. 12; XXXV., figs. 10–12.)

Hormathia margaritæ, g. et sp. n., Gosse, .	1859, Ann. Mag. Nat. Hist. (3), iii., p. 47.
Hormathia margaritæ, Gosse, . . .	1860, Actinologia Britannica, p. 219, pl. viii., fig. 1.
Hormathia margaritæ, Schulze, . .	1875, Jahresb. Com. Untersuch. Deutschen Meere, Kiel, Exped., 1872, p. 140.
Hormathia margaritæ, Andres, . . .	1884, Le Attinie, p. 364.

Previously-known Localities.—Moray Firth, near Banff; deep water, clasping a living *Fusus antiquus* (P. H. G.); N.E. Scotland, 69 faths. Station No. 79, on *Fusus antiquus* (F. E. S.).

Description of a single preserved specimen.—Body very contractile; base broader than column, somewhat recurved; column transversely rugose, apparently due to contraction; upper portion of contracted body with twelve small elongated "coronal" tubercles or ridges, which extend some distance along the invected capitulum; circular muscle very strong.

Colour.—Yellowish in spirit.

Dimensions.—Average diameter at base 13 mm.; height of fully contracted specimen 6 mm.

Locality.—Shetland, Rev. A. W. Norman.

I have previously stated that I have had doubts whether I should provisionally keep this specimen distinct from the above species. This was simply on account of the absence of any information, first as to the appearance of a contracted *H. margaritæ*, and secondly, as I had no information as to the appearance of the animal when alive. Canon Norman doubtfully labelled it "*Tealia digitata*," and on sending it to me drew my attention to its probably being distinct therefrom. I mention this as it is direct evidence that it probably resembled that species when alive. A comparison of Mr. Gosse's figure of this species (**1860**, pl. viii., fig. 6) and the accompanying figures of *C. digitata* (Pl. XXXII, figs. 9 & 10) will indicate the general resemblance between them, which would doubtless be still further increased were contracted specimens compared.

The mesoglœa of the specimen investigated is not so thick as in that of *Chondractinia digitata.* A comparison of figs. 12 & 6, Pl. xxxv., will show distinctions between these two species. The mesoglœal circular muscle is very strong, and exhibits certain well-marked characters (Pl. xxxv., figs. 10, 11). In a vertical section the muscular masses are arranged in regular tiers, so that the dissepiments between them appear as parallel lines which externally, *i.e.* towards the ectoderm, are looped something like the tracery of a Gothic church window. It is probable that this peculiar disposition of the muscles will prove of great service in the future identification of this species. The specimen was a female.

CHITONACTIS, Fischer, 1874.

Chondractininæ, with thick mesoglœa, permeated by strands of "mesodermal" muscle-fibres; circular muscle very large; capitulum smooth; twelve pointed coronal tubercles; scapus provided, especially in its upper portion, with pointed papillæ more or less regularly disposed, twelve rows being prominent. Cuticle largely developed on the papillæ.

From a personal knowledge of some examples of Gosse's *Bunodes coronata*, which he obtained from the Bay of Biscay, M. Fischer found that the English author had allocated the species to the wrong genus, and therefore he proposed a new genus for it (**1874**, p. 226).

SPECIES OF THE GENUS CHITONACTIS.

Chitonactis coronata (Gosse).

English Channel; Bay of Biscay; South-west of Ireland.

Chitonactis marioni (Haddon).

Off South-west of Ireland, 325 faths.; Bay of Biscay.

Chitonactis spinosa (R. Hertwig).

South Indian Ocean, lat. 53° 55′ S.; long. 108° 35′ E.; 1950 faths.; off Japan, 1875 faths.

Chitonactis minuta (R. Hertwig).

South Indian Ocean, lat. 46° 16′ S.; long. 48° 27′ E.; 1600 faths.

(?) **Chitonactis longicornis** (Verrill).

Off North-east coast of America, 100–325 faths.

Chitonactis coronata (Gosse).

Bunodes coronata, n. sp., Gosse,	1858, Ann. Nat. Hist. (3), ii., p. 194.
Bunodes coronata, Gosse,	1860, Actin. Brit., p. 202, pl. vii., fig. 4.
Bunodes coronata, Schulze,	1875, Jahresb. Com. Untersuch. Deutschen Meere, Kiel, Expd., 1872, p. 140.
Chitonactis coronata, Fischer,	1874, Nouv. Arch. Mus. d'Hist. Nat. x., p. 226.
Chitonactis coronata, Andres,	1884, Le Attinie, p. 124.

Distribution—S. Devon, moderately deep water, 20 faths. (P. H. G.); N. E. of Hasborough Station, 108, 12 faths. (F. E. S); Port of Arcachon, 20–45 faths. (P. F.); South-west of Ireland, 50 faths. (A. C. H.).

Just before sending to press the present Memoir I was entrusted with some Actiniæ, dredged off the south-west coast of Ireland in June, 1888; the Report of the Expedition which dredged these specimens will shortly be published in the Proceedings of the Royal Irish Academy. Having no time at my command, I am reluctantly obliged to postpone an anatomical investigation on these forms. Amongst them were two specimens which, from their general appearance, and their agreement with the accounts given us by Mr. Gosse and M. Fischer, I am confident belong to the above species.

The following is a description of the two preserved and retracted specimens sent to me:—

Base much expanded, clasping the shell of a Fusus inhabited by a hermit-crab; column transversely wrinkled, studded with small conical pointed warts which do not appear to have any definite arrangement, but are more numerous at the upper portion of the contracted body, and are absent, or nearly so, on the expanded base; the coronal tubercles not distinguished from the others by size; the invection of the upper portion of the body is so complete that no distinct orifice is present when fully contracted. The body wall is thin but not flaccid; the mesoglœal circular muscle is well developed. The specimens had in spirits a dirty drab colour. The œsophagus and disc had traces of a scarlet colouration. Average diameter of base about 25 mm.; average height of contracted specimens, 15 mm.

Chitonactis marioni, n. sp.

(Plates XXXI., figs. 1, 2; XXXIII., figs. 7, 8, 9; XXXV., figs. 8, 9.)

Form.—Body columnar when extended; conical when contracted, with expanded base attached to a spine of *Dorocidaris papillata.* The basal disk extends along the spine to about twice the average diameter of the column; the edges of the basal disk fuse on the opposite side of the spine. The column is provided with irregularly-disposed, small, unequal, sharply-pointed tubercles; these are farther apart and smaller towards the base. The general surface of the column is quite smooth. The upper portion of the column, or rather of the scapus, where it passes into the capitulum, is vandyked, each of the triangular spaces whose apex points upwards being provided with a strong tubercle. The capitulum is short, smooth, with twelve ridges corresponding with the apices of the tuberculated triangles just mentioned; when contracted, these ridges and the tubercles give the appearance of an irregular twelve-rayed rosette. Tentacles rather short and thin; probably 48 in number (6 + 6 + 12 + 24). Disc slightly conical; mouth an elongated slit at right angles to the long axis of attachment.

Colour.—Body pale greenish-grey; tubercles of a darker colour; capitulum pink, the vandyked lower margin and the ridges being white; the latter thus dividing the capitulum into twelve pink panels. Tentacles, primary and secondary, pale-pink, irregularly splashed with madder brown; on their oral aspect a few are simply translucent pink; the remainder are longitudinally striped by extremely delicate lines, usually with the proximal portion of the tentacle strongly-coloured madder brown; tertiary tentacles translucent white. There are white lines between the bases of the tentacles, evidently indicating the mesenteries, disc pinkish, irregularly but finely splashed with madder brown, lips white, œsophagus pale flesh-colour. In the contracted spirit specimen the ground colour of the column has bleached, and the tubercles have a more yellowish tinge.

Dimensions.—Height, when extended, about 30 mm.; diameter of column 16 mm.; extreme length of pedal disc 35 mm.; length of tentacles 10 mm. The measurements of the specimen in spirit are: height 13·5 mm.; narrow diameter of middle of column (*i. e.* at right angles to line of attachment) 18 mm.; length of pedal disk 34 mm.

Locality.—Attached to a spine of *Dorocidaris papillata*, from 325 fathoms off the south-west coast of Ireland, 53 miles W. ½ S. of Dursey Head, fine sand. (A reference to the capture of this specimen will be found in the "Narrative of the Cruise" in the "Second Report on the Marine Fauna of the South-west of Ireland," Proceedings, Royal Irish Academy, vol. i., 3rd ser., p. 35, 1888.)

On my submitting a sketch of this specimen to Professor Marion, he informed me that it was similar to others which had occurred in the "Travailleur" dredgings; at the same time he kindly gave me proof copies of three unpublished plates which were intended to illustrate the final Paper, of which a preliminary account has appeared (**1882**). On one of the plates was figured a form which, according to a pencil memorandum, Professor Marion regarded as a young example of his *Chitonactis richardi.* Fortunately I possess a fair series of young specimens of this species which, as a matter of fact, very closely resemble the adult form. Apart from this, there are a sufficient number of characters which serve to distinguish the two species in question. It affords me great pleasure, therefore, to associate this species with the name of my distinguished French colleague.

In a vertical section it is seen that the circular mesoglœal muscle has a considerable longitudinal extension: the disposition of the muscular strands is shown in Pl. xxxv., fig. 8. The mesoglœa of the body-wall is not thick; that of the mesenteries is thin; it recalls that of Paraphellia. The general character of the retractor muscle of the mesenteries (Pl. xxxv., fig. 9) is somewhat similar to that in Actinauge. It is instructive to compare my figure 8 with those given by Professor Hertwig for *Cereus spinosus* (**1882**) in *l. c.* pl. vi. fig. 1, and pl. viii. fig. 6.

? Chitonactis longicornis.

Urticina longicornis, n. sp., Verrill, .	1882, Am. Journ. Sci., xxiii., p. 222.
Actinauge longicornis, Verrill, . .	1883, Bull. Mus. Comp. Zool., xi., p. 53, pl. v., figs, 1, 2.
Actinauge longicornis, . . .	1885, Rep. U. S. Fish. Com. for 1883, pp. 514, 534, pl. viii., fig. 21.

This form appears to me to belong to the genus Chitonactis.

Prof. R. Hertwig, in his "Report on the Actiniaria," collected by the "Challenger," (**1882**), rediagnoses the genus Cereus of Oken, and modifies that genus as emended by Prof. Verrill (**1869**, p. 480). By so doing he necessarily eliminates the type species (*C. bellis* = *C. pedunculatus*) from the genus. I agree entirely with Prof. Verrill's interpretation of the genus Cereus, and consequently cannot agree with Dr. Hertwig in his "wish to attach more importance in the diagnosis to the papillose nature of the wall, in order to establish a sharp distinction between this genus and Sagartia," (**1882**, p. 76). This is almost accepting the genus as defined and obscured by Prof. Milne Edwards (**1857**, pp. 263–273).

As I cannot admit that the new species described by Dr. Hertwig as *Cereus spinosus* (**1882**, p. 76, pl. i., figs. 3–5, etc) belongs to that genus, another resting-place must be found for it. Prof. Marion informs me by letter, and I perfectly agree with him, that he considers that this species belongs to the genus Chitonactis. I propose therefore to name it *Chitonactis spinosus* (Hertw.), and it has the appearance of being a very typical member of that genus.

Equally characteristic of the genus Chitonactis is the species which Prof. Hertwig has named *Bunodes minuta*, n. sp. (**1882**, p. 84, pl. ii., fig. 12 *a* & *b*). I have already alluded to this species, and need only say that the description of it, as given by my German colleague, entirely corresponds with the position to which I would assign it. The genus Bunodes, as represented by its type species, *B. verrucosa* (Pennant) = *B. gemmacea* (Ellis) certainly requires to be anatomically studied; but I venture to prognosticate that it will not prove to be a member of the Sagartidæ.

ACTINAUGE, Verrill, 1883.

Chondractininæ with very thick mesoglœa; circular muscle very large; capitulum with twelve ridges corresponding with the twelve coronal tubercles; scapus strongly tuberculate, or nodulate; cuticle present, especially on the tubercles; inner three rows of tentacles with a swollen base.

This genus was erected by Professor Verrill for some large forms which he took to be the *Actinia nodosa* of Fabricius. From a personal examination I am satisfied that the latter is quite distinct from Prof. Verrill's Actinian, which in its turn is very closely allied to the *Chitonactis richardi* of Prof. Marion (**1882**, p. 460). The bulbous base of the inner tentacles and the character of the tubercles and of the capitulum are sufficient to remove these forms from the genus Chitonactis, so we may utilize Prof. Verrill's genus while discarding his species.

Prof. Verrill describes the genus in the following terms:—

"Large Actinians, with the tentacles and upper part of the body capable of involution. Integument of body of two kinds: that of the lower part is firm, thick, and more or less coriaceous or parchment-like, with persistent, solid warts or tubercles, usually in vertical rows, and sometimes partially covered with a thin chitinous epidermal coating; that of the upper part of the body forms a marginal brighter-coloured band, below the tentacles, where it is soft and lubricous, secreting mucus abundantly, and rising into longitudinal ridges, crests, or oblong tubercles, which run to and unite with the basis of all [some of] the tentacles. The basal disk may be broad and flat, adherent, or it may be bulbous, clasping mud, or it may ensheathe the branches of Gorgoniæ, etc. Tentacles long and large, contractile [those of the inner cycles having a basal bulb]; lips with large folds and gonidial grooves." (**1883**, p. 50).

I have quoted Prof. Verrill's diagnosis of the genus in full, but I would modify it by stating that the capitular ridges run to some, not to "all" the tentacles, and by adding a note on the bulbous base of the tentacles, these alterations are placed in brackets in the foregoing description. Lastly, I would speak of them as "Large Chondractininæ, with the tentacles," etc.

Prof. Verrill believed that this genus "is also closely allied to Urticina, Ehr. (Tealia, Gosse), of which the type is *U. crassicornis* [*U. felina*]. But the latter has the integument soft and lubricous over the whole body, and there is no marked specialization of the submarginal zone: the tubercles, when present, are small, not much thickened, and of the nature of true suckers for attaching foreign substances; and when not in use may so contract as to disappear entirely; the submarginal zone is nearly smooth, with a definite upper margin, and there are no vertical ridges running in on the disk to join the bases of the tentacles, as in this genus and in Actinerus."—[Verrill.] It is now certain *Urticina felina* is very different in every respect from any of the known species of Actinauge.

SPECIES OF THE GENUS ACTINAUGE.

Actinauge sp. (?) (*A. nodosa*, Verrill, not of Fabricius).

North-east coasts of America, 86–1098 faths.

Actinauge richardi (Marion).

Bay of Biscay (considerable depths); south-west of Ireland, 50–110 faths.

Actinauge (sp.)?

Urticina nodosa, Verrill (not of Fabricius),	1873, Amer. Journ. of Sci., vi., p. 440.
Urticina nodosa, Verrill, ...	1874, ibid., vii., pp. 413, 500, pl. vii., fig. 7.
Urticina nodosa, Smith and Harger, .	1874, Trans. Connect. Acad., iii., pp. 11, 54.
Urticina nodosa, Verrill, ...	1882, Amer. Jour. Sci., xxiii., pp. 224, 315.
Actinauge nodosa, Verrill, ...	1883, Bull. Mus. Comp. Zool., xi., p. 50, pl. vi., figs. 6–8*a*.
Actinauge nodosa, Verrill, ...	1885, Rep. U. S. Fish Com. for 1883, pp. 415, 534, pl. v., fig. 20.

Abundant off the north-east coasts of America, from 86–1098 faths.

This species has been well described by my American colleague so far as its external appearance is concerned (**1883**). From the description given by Dr. Fabricius of his *Actinia nodosa*, there was nothing to lead Prof. Verrill to suppose that his was other than that species, or at most a variety of it. Thanks, however, to a personal acquaintance with a single specimen of the Greenland species, which was named by Dr. Lütken, I am able to state definitely what it really is (p. 308), and I find that the typical American species is quite distinct. It is, however, quite possible that the very nodular form described by Prof. Verrill as *A. nodosa*, var. *tuberculosa*, is the true "*Actinia*" *nodosa*. The description (**1883**, p. 53, pl. vi., fig 7, and **1885**, pl. v., fig. 20*a*) agrees perfectly well with the specimen I have examined, with the exception that in Prof. Verrill's form, "The upper retractile border [capitulum] has irregular, strong, longitudinal, unequal crests." In the specimen I examined the capitulum is smooth, or at most with fine longitudinal creases, due to contraction. But Prof. Verrill himself says, "This is a remarkable form, perhaps a distinct species."

If my observations are correct, the type species of the genus Actinauge is without a name; for it would be very misleading to retain the specific name of *nodosa*, owing to its history, even though *A. nodosa*, Fabr., is relegated to another genus. We might retain one of the two varietal names of *coronata*, Verr., or *tuberculosa*, Verr., as the specific name of the type. For the following reasons I cannot see my way to so doing. Prof. Verrill overlooked the presence of the tentacular bulbs in the type forms, and we have no information whether they are present in these two varieties. If present, it would form strong evidence in favour of their being varieties of the type species of Actinauge: if absent, they probably belong to different genera. The latter, as I have just mentioned, may possibly be the true *Actinia* (*Chondractinia*) *nodosa*. The former certainly suggests the genus Hormathia (see p. 309), or perhaps a variety of Chondractinia (see p. 305). Prof. Verrill, however, informs us that "Intermediate states between this and the normal form [Actinauge] are not rare, (**1883**, p. 53). As so much doubt exists, I prefer to leave the specific name of this form still an open question; but if distinct, it might be named after the distinguished American zoologist who has so greatly advanced our knowledge of American Marine Zoology.

The American specimens are "usually" white, dull pale-red, flesh-colour, or salmon; . . . sub-marginal zone is bright-red, orange-brown, or chocolate-brown, often in lighter or darker stripes. The tentacles are usually dark-pink, salmon, or orange-brown, varying to dull-red, or chocolate-brown. Disc usually orange, or reddish-brown, or chocolate, with lighter and darker radii, (*l. c.* **1883**, p. 52).

This species occurs abundantly off the North-east coasts of America, from 86–1098 faths., Verrill (**1885**, p. 534). Prof. Verrill (**1883**, p. 52) says, "I have also received two examples from Denmark, through Dr. Chr. Lütken, of the Copenhagen Museum, which, so far as can be seen from the alcoholic specimens, agree perfectly with some of our less nodose varieties. These were sent as *Actinia digitata*, Müller. But the *Actinia* (or *Tealia*) *digitata* of Gosse and several other European writers may be a distinct species."

Owing to the kindness of Canon Norman, I have been able to examine two spirit specimens of the above species. They undoubtedly appear to be quite distinct, specifically, from the British specimens of *A. richardi*, which I have studied; but then, again, there are strong resemblances between the former and the figures on Prof. Marion's unpublished plate. We can only await the decision of Profs. Verrill and Marion as to the identity of their forms.

Actinauge richardi (Marion).

Plates xxxi., fig. 6; xxxiii., fig. 10; xxxiv., figs. 5–7.)

Chitonactis richardi, n. sp., Marion, .	1882,	Comptes rendus, xciv., p. 460 (trans. Ann. Mag. Nat. Hist. (5), ix., 1882, p. 335).
Chitonactis richardi, Andres, . .	1884,	Le Attinie, p. 130.
(?) *Actinia tuberculata*, n. sp., Cocks, .	1851,	Nineteenth Annual Rep. Roy. Cornwall Polytech. Soc., p. 7., pl. ii., fig. 8.
(?) *Tealia* (?) *tuberculata*, Cocks, Gosse,	1860,	Actin. Brit., p. 217.

This handsome species was referred to, but not fully described, by Professor Marion (1882). On submitting a coloured sketch of some Irish specimens of Actiniæ to Prof. Marion, he assured me that this was his species, and at the same time he kindly sent me proofs of some unpublished plates of his which entirely confirmed his statement. I would take this opportunity of acknowledging the cordial manner in which this distinguished French zoologist has rendered me assistance by correspondence, and his kindness in sending to me the proofs of his unpublished plates.

Prof. Marion also informed me, by letter, that he had obtained "this species from 70 mètres to 2000 mètres. It is very polymorphic: the tubercles of the column may increase or almost disappear. The same obtains for the cuticular layer. The foot is prehensile, forming an ampulla, or it may seize hold of an Holtenia or an Isis, and develop lobes. The tubercles of the arm even may be somewhat diminished."

DESCRIPTION OF SOME IRISH SPECIMENS.

Form.—Body cylindrical, both when extended and contracted, and preserved in alcohol; general surface of column smooth, studded with rounded warts, which have a tendency to run into longitudinal rows; pedal disc not expanded, even when the animal is attached to a flat surface; usually the pedal disc is bent round ventrally, the edge being constricted so as to form a cup-shaped concavity, which is filled with sand. The pedal disc thus grips the bottom, and forms an efficient sand-anchor. In two cases the base surrounded a small Natica shell. The capitulum is smooth and slimy, and traversed by twelve strong ridges, each of which divaricates above, and is continuous with the base of a tentacle of the fourth cycle. Tentacles in five cycles, 96 in number (6 + 6 + 12 + 24 + 48). The inner rows are of moderate length, and provided with a well-marked swelling on the abactinal (ventral) aspect of their base. This enlargement is especially prominent on the tentacles of the three inner cycles. The tentacles of the outermost row are short, without basal bulbs; oral disc smooth, flat; mouth usually oval, with tumid lips.

In the contracted specimens the column is distinctly nodular, the nodules being very irregular both as to size and distribution. A general vertical (longitudinal) arrangement can, however, be occasionally discerned. The tubercles are larger in the upper portion of the column, twelve very prominent ones usually occurring at the bases of the capitular ridges. The nodules become much smaller at the proximal end of the column, so that the constricted edge of the basal disc may be described as tesselated.

Colour.—Column dirty-white, tinged with green; tubercles dull-green; capitulum whitish; tentacles white, or flesh-colour, the oral aspect of the two inner rows variously streaked with madder, or chocolate-brown, sometimes almost of a burnt sienna-brown; basal bulbs always white; outermost tentacles not marked with brown; disc white, streaked and splashed with the same shades of brown as the tentacles; lips usually white; œsophagus either deep madder brown or mahogany colour, or whitish, streaked with brown. In one specimen the disc and all the tentacles were of a pure translucent white, the deep reddish-brown colour of the œsophagus showing up in strong contrast through the gaping mouth.

Dimensions.—The following are the measurements of four specimens preserved in alcohol:—23 mm. high × 19 mm. in diameter; 37 × 29; 43 × 28; 45 × 30.

Locality.—50–110 faths. off the south-west coast of Ireland. (*A*) one specimen from 70–80 faths, 5–8 miles W. of Great Skellig; fine muddy sand, anchored in the sand; (*B*) one specimen, attached to shell of a dead Pinna, 100 faths., 35 miles W. $\frac{3}{4}$ S. of Dursey Head, sand; (*C*) six specimens, two surrounding shell of a small dead Natica, the remainder with basal concavity grasping the sand; 100 faths., 43$\frac{1}{2}$ miles W. $\frac{3}{4}$ S. of Dursey Head; (*D*) one specimen from 50 faths., off Glandore.

The great development of the mesoglœa is a noticeable feature in *Actinauge richardi*. The retractor muscles of the mesenteries extend throughout nearly their whole width (Pl. XXXIV., figs. 6 & 7). Even those of the quaternary mesenteries are developed (fig. 7, iv.). The circular muscle of the endoderm (figs. 7 & 9, *c. m. en.*) is not conspicuous. The ectoderm is rubbed off in places, but usually on the tubercles it persists, being protected by a thick cuticle (fig. 8, *cu.*). The circular sphincter muscle is well developed: its character in longitudinal section is seen in fig. 9. The bulbous base of the three inner rows of tentacles is due to a local thickening of the mesoglœa.

I have, doubtfully, referred *Actinia tuberculata* (Cocks) to this species. The account in Mr. Gosse's monograph, which extends the original description, certainly supports the conclusion that it may be a variety of *Actinauge richardi*. Through the kindness of Mr. Gosse I have been enabled to examine a life-size drawing made for him by Mr. Cocks; in this drawing the tubercles are represented as relatively much smaller and more numerous than in the published figure; the latter certainly more closely resembles the appearance of the Irish specimens. Some of the tentacles are said to be "bifurcated." From the drawing just referred to, I am inclined to believe that the bifurcation is a slight misinterpretation of the bulbous base of the tentacles. In our specimens the swelling was, in some cases, so prominent as quite to suggest a bifid tentacle. In addition to this, some of the tentacles in Mr. Cocks' unpublished sketch are very irregular; whether this is due to an abnormal growth of the tentacles, or whether Mr. Cocks has inadvertently drawn torn tentacles, I cannot say; but it may be confidently asserted that these tentacles are not normal.

PARAPHELLIA, gen. nov.

Chondractininæ with thin mesoglœa; circular muscle relatively small; capitulum smooth, no coronal tubercles; scapus smooth or slightly corrugated; cuticle not developed; body encrusted with sand; base large, often very widely extended.

This is a new genus, erected for a single species, which has hitherto only occurred off the south-west of Ireland.

Paraphellia expansa (Haddon).

Mouth of Bantry Bay, South-west of Ireland; 40 faths.

Paraphellia expansa (Haddon).

(Plates XXXII., figs. 1–4; XXXIII., fig. 6; XXXIV., figs. 1–4.)

Chitonactis (?) *expansa*, n. sp., Haddon, . . 1886, Proc. Roy. Irish Acad. (2), IV., Science, p. 616.

Form.—Column, scapus usually very depressed and turban-shaped, but when weakly or dead obtusely conical, corrugated. Base flattened out and much and variably extended in different directions, the edges crenulated by the insertion of the mesenteries, of which there are about 100; when dead the base may be withdrawn beneath the extended scapus; capitulum short, invisible when the animal is fully open, crenulated by the mesenteries of the three inner cycles of tentacles when the animal is partially closed, and when the animal is retracted it almost completely covers over the tentacles.

Tentacles short, conical, quadricyclic, 48 in number (6 + 6 + 12 + 24).

Disc perfectly flat.

Mouth, with fairly prominent lips, oval or round when open; usually more or less cruciform when closed.

Colour.—Column, base, translucent buff; scapus, pinkish or flesh-coloured; capitulum, translucent pink; the mesenteries of the primary cycle of tentacles are marked by a pair of somewhat triangular deep madder-coloured spots, the three intervening lobes having a pale yellow spot in their centre.

Tentacles pale translucent madder, with a pale brown terminal spot, and lateral rows of similar spots.

Disc, dark sepia, with six pairs of radial cream-coloured lines extending from the bases of primary tentacles to the mouth, and six pairs of similar smaller converging lines, which arising from the bases of the secondary tentacles die away before reaching the mouth. A row of small cream-coloured spots runs down the central line of each of these twelve areas. A pair of short brown lines extends from the base of each of the tertiary tentacles; this is surmounted and prolonged by a row of small cream-coloured spots, which half-way across the disc unite to form a single median row, which terminates near the mouth: in the triangle thus formed by these converging rows of spots is a short central row of similar spots.

Mouth, lips of a fleshy-brown colour; inside of mouth of a deep madder-brown colour.

When obtained the body of one specimen was entirely covered with grains of sand and broken shells (Pl. XXXII., figs. 1–4); the other with fine sand only (Pl. XXXIII., fig. 6).

Dimensions.—Diameter of base, 21–25 mm.; diameter of scapus, 12 mm.; diameter of disc, 7 mm.

Habitat.—Mouth of Bantry Bay; depth, 40 faths.; bottom coarse sand.

Two specimens of this new genus and species were obtained from the same locality. The first was found in 1885, and described the following year (Haddon, 1886, p. 616); in the latter year the second specimen was dredged; this specimen closely resembled the preceding. I believe they are sufficiently distinct from previously described species to warrant the erection of a new genus to contain them.

The mesoglœa is relatively feebly developed in this genus, as is specially noticeable in the œsophagus and mesenteries (Pl. XXXIV., figs. 1, 2 & 4). That of the body wall is of medium thickness. The longitudinal retractor muscles of the primary mesenteries are narrow and reniform in section below (fig. 2), but are broader above (fig. 1).

The secondary and tertiary mesenteries alone bear generative organs. The single specimen sectionized was a female; the secondary mesenteries had their ovaries in their lower third (figs. 2 & 3), while those of the tertiary mesenteries occurred on the middle third. The mesenteries of the fourth rank nowhere projected above the endoderm in this specimen.

The circular muscle of the endoderm of the body-wall (fig. 4) is well developed, and, as in other Chondractininæ, separates the mesoglœa of the mesenteries from that of the body-wall.

As stated above (p. 304), I do not think the time has yet arrived when it is possible to satisfactorily classify the majority of Sagartians. I wish, however, to take this opportunity of making a few notes on some British examples of those which do not belong to the sub-family Chondractininæ.

The genus Sagartia, Gosse, *sensu stricto*, must be retained for *S. miniata*, Gosse (? *S. elegans*, Dal.), *S. venusta*, Gosse; *S. nivea*, Gosse; and *S. rosea*, Gosse, as has already been pointed out (p. 302). Doubtless many non-British forms will find a place here; but it must be by their conforming in structure to these type species. The definition of the genus cannot be modified in any important manner.

The form called by Mr. Gosse *Sagartia* (*Scyphia*) *bellis* (Ell. and Sol.) is the type of the genus Cereus (Oken). Its more correct name is *Cereus pedunculatus* (Penn.).

If strict priority be observed, the species commonly known as *Actinoloba dianthus* (Ell.) will have to be called *Metridium senilis* (Linn.).

The genus Cribrina was introduced by Prof. Ehrenberg (**1834**, p. 264) for those Actiniæ, "poris lateralibus instructa," with the following as its species:— 1. *C. verrucosa*, E. (= *A. verrucosa*, Lam. = *Hydra verrucosa*, Gaertn.); 2. *C. glandulosa*, E. (= *A. glandulosa*, Otto); 3. *C. coriacea*, E. (= *A. coriacea*, Cuv. = *A. senilis* Linn.); 4. *C. effoeta*, E. (= *A. effoeta*, Bast.; nec *Priapus polypus*, Forsk.); 5. *C. polypus*, H. and E. (= *P. polypus*, Forsk. = *A. priapus*, Gmel. = *A polypus*, Blainv., nec. *A. effoeta*, Rapp.). As a general rule, the first-mentioned species of a new genus is to be taken as its type; but in this case the type is undoubtedly the fifth species, *C. polypus*. It is evident that it was intended to publish the genus with this species as its type in the "Symbolæ physicæ," which was brought out by Herren Ehrenberg and Hemprich; but I can find no trace of this having been done. At all events, Prof. Ehrenberg associates Hemprich's name with his own both for the genus and for this species, but for no other species. Thus the author regarded it as typical. The genus is based upon, and named from, the presence of lateral pores; none of the first three named species are perforated; therefore on this ground alone we are justified in limiting the generic name to its perforated members. The genus Cribrina then has *C. polypus* (Forsk.) for its type species. I am aware that this species is possibly a synonym for *C. effoeta* (Linn.).

The genus Calliactis, Verrill (**1869**, p. 481), is very closely allied to Cribrina, *s. s.* If they are identical the older name must stand.

It is now admitted by many zoologists that *A. parasitica*, Couch, is *A. effoeta*, Linn.; but Dr. Andres in his monograph (**1884**) makes *A. effoeta*, Linn., and *A. viduata*, Müll., the same species; and he gives *A. parasitica* as a synonym of *A. rondeletii*, D. Ch. Personally, I am inclined to follow M. Fischer (**1874**) and others in regarding *A. parasitica* as a synonym of *A. effoeta*, Linn. (not, however, "*A. effoeta*," as M. Fischer spells it). The correct name of this form is therefore *Cribrina effoeta* (Linn.).

The only anatomical account we have of the genus Phellia consists of two semi-diagrammatic figures of *Phellia limicola*, Andr. (figs. 2 & 3), in the Introduction of Prof. Andres' monograph (**1884**, pp. 73, 74). From these figures it appears that only the six primary pairs of mesenteries are perfect, and at the same time they alone bear the generative organs. Acontia are present. No mesoglœal circular muscle is indicated as being present.

While Phellia may be placed among the Sagartians—by the possession of acontia—we cannot regard it as belonging to the Chondractininæ.

Sagartia, sp.

Figures of a Sagartian are given on Pls. XXXII., fig. 6.; XXXIII., fig. 5, which I have not time to properly describe or identify, and I prefer to leave them unnamed to hazarding an untrustworthy determination. It was found attached to a Caryophyllia at a depth of 16 faths., 42 miles off the Great Skellig, south-west of Ireland, in 1886.

Base expanded, attached to side of a large Caryophyllia (Haddon, **1888**, p. 36); scapus translucent pink, with attached grains of sand; capitulum elongated, translucent white; opaque white spots at base of tentacles; tentacles short, swollen, conical, pinkish, with madder ring near their base; disc pinkish; lips madder.

Gephyra dohrnii, Von Koch.

(Plates xxxi., figs. 3–5; xxxiii., figs. 3, 4.)

Gephyra dohrnii, g. and sp. nn., Von Koch,	1878, Morph. Jahrb. iv., Suppl., p. 78, pl. v.
Gephyra dohrnii, Andres, ...	1880, Mitth. Zool. Stat. Neapel., ii., p. 314.
Gephyra dohrnii, Marion, ...	1882, Comptes rendus, xciv., p. 458 (transl. in Ann. Mag. Nat. Hist. (5), ix., 1882, p. 334).
Gephyra dohrnii, Hertwig, ...	1882, "Challenger" Rep. Actiniaria, vol. vi., pt. xv., p. 86.
Sagartia dohrnii, Andres, ...	1884, Le Attinie, p. 166.
Sagartia dohrnii, Carus, ...	1884, Prod. Faunæ Medit., i., p. 70.
Gephyra dohrnii, Haddon, ...	1886, Proc. Roy. Irish Acad. (2), iv., Sci., p. 616.

Distribution.—Mediterranean, Bay of Biscay, South and South-west of Ireland.

DESCRIPTION OF IRISH SPECIMENS.

A. Column smooth; base large and thick, more or less surrounding the stems of a Tubularian, to which it is attached, sometimes completely enwrapping them, the two edges of the basal disc fusing to form a short open tube; no horny or cuticular deposit was noticed. The disc and tentacles can be completely retracted; in that condition the column is conical in form.

Tentacles short, conical, but rather slender, tricyclic, 12 + 12 + 24; the tentacles of the first two cycles are about of equal length; those of the outer row are shorter than the others.

Disc raised, produced in the centre into a turban or even trumpet-shaped oral protuberance; mouth more or less circular.

Colour.—Column pale, pinkish orange, often more pink, especially the ventral surface of the disc; tentacles, primaries slightly darker than the disc; tertiaries lighter, translucent, without any markings.

Disc translucent pale orange, with 24 pale radiating lines, indicating the mesenteries; oral portion of disc with 12 dark orange lines, which are inclined to be thicker towards the periphery. This portion of the disc is separated from the remainder by a white circle; throat deep orange. The twelve primary tentacles have an almost complete deep orange ring at their base.

Locality.—About 30 miles off the Fastnet, south-west of Ireland, 80 faths.; and 9 miles south of Glandore, 40 faths.

B. These specimens were taken on another occasion, and the following notes were taken:—Body translucent orange or flesh colour; disc translucent, white ring round mouth; the insertions of the mesenteries appear as double white radial lines; œsophagus pinkish orange or flesh colour; tentacles translucent flesh colour, with darker line round the base and at the tip; mouth at right angles to long axis of attachment. Tentacles, apparently, 12 + 12 + 24.

Locality.—5–8 miles west of Great Skellig; south-west of Ireland, 70–80 faths.

C. At the same time the following Actiniæ were obtained, which I take to be a variety of the same species (pls. XXXI., fig. 3; XXXIII., figs. 3 & 4). Colour, uniform bright cherry; disc and base expanded; scapus constricted; mouth nearly circular; diameter of disc 14 mm. The base secretes a cuticular secretion. Formula of tentacles, 12 + 12 + 24 + 48 = 96.

Same locality as preceding; attached to stems of Tubularia, &c.

On submitting coloured sketches of these specimens to Prof. Marion, he informed me that "your *Gephyra dohrnii* is identical with the Mediterranean forms." Its range is now extended from the Mediterranean to British waters. So far as they have gone, my investigation on the anatomy of this form, on specimens both from the south-west of Ireland and the Bay of Naples, proves that it belongs to the series of typical Sagartians; but I cannot regard it as belonging to the genus Sagartia, as above restricted.

I venture to call Prof. Verrill's attention to the need of re-examining his *Sagartia spongicola* (**1883**, p. 47, pl. vi., fig. 3; and **1885**, p. 534, pl. vii., fig. 200). It has very close resemblance to this species.

Fam. EDWARDSIDÆ, Andres (1880).

Elongated Actiniæ with a vesicular base; eight mesenteries only present, including two pairs of directive mesenteries; the remaining four mesenteries are unpaired; all the mesenteries bear reproductive organs; tentacles simple, usually more numerous than the chambers of the cœlenteron.

Sole genus.—EDWARDSIA, Quatrefages (1842).

Column long, cylindrical, divided into capitulum, scapus, and physa; the capitulum and physa are retractile, the scapus usually invested with a friable cuticle; tentacles variable in number, from 16–32 in the adult condition (occasionally 8 in number?)

The number and disposition of the mesenteries are alone sufficient to render the genus Edwardsia well defined, and, in the present state of our knowledge, sufficiently so to warrant it standing as the sole genus in the family of the Edwardsidæ.

Prof. Andres (1883) subdivides the Edwardsidæ into two genera—Edwardsia, provided with 16 tentacles; and Edwardsiella, with more than 16 tentacles. Other characters are mentioned, none of which, however, appear to be of much value. As the number and arrangement of the tentacles in the Edwardsidæ are so irregular, I prefer, with my friend Mr. G. Y. Dixon (1886), to relegate all the species to the one genus.

BRITISH SPECIES OF EDWARDSIA.

EDWARDSIA BEAUTEMPSII, Quatrefages.	EDWARDSIA ALLMANI, M'Intosh.
,, CARNEA, Gosse.	,, GOODSIRI, M'Intosh.
,, TIMIDA, Quatrefages.	,, TECTA, n. sp.

(?) E. CLAPARÈDII, Pancer sp.

Edwardsia beautempsii, Quatrefages.

(Plates XXXIII., fig. 17; XXXVI., fig. 4.)

Edwardsia beautempsii, n. sp., Quatrefages,	1842, Ann. des Sci. Nat. (2), xviii., p. 69, pl. i., fig. 1.
Scolanthus callimorpha, n. sp., Gosse, .	1858, Ann. Nat. Hist. (2), xii., p. 157, pl. x.
Edwardsia callimorpha, Gosse, . . .	1860, Actin. Brit., p. 255, pl. vii., fig. 7.
Edwardsia beautempsii, Andres, . . .	1884, Le Attinie, p. 92.
Edwardsia beautempsii, Pennington, . .	1885, Brit. Zooph., p. 177.

(For full bibliography consult Andres.)

Dr. A. Andres was the first to connect Mr. Gosse's species with that of M. de Quatrefages; in this as in other matters he has been followed by Mr. Pennington. I have very carefully compared the published accounts, and with the further advantage of being acquainted with the animal itself, and of having access to a coloured drawing of Mr. Gosse, I have come to the opinion that the forms are identical, and consequently Mr. Gosse's name must give place to that of M. de Quatrefages. As a matter of fact, the Irish specimen is intermediate, so far as colour and markings are concerned, between the types described by these authors, and thus demonstrates their identity.

The following is a description of the single specimen we obtained:—

Form.—As in Mr. Gosse's description, the physa is short and rounded; at certain times it *appears* as if the apex was perforated.

Colour.—Scapus, tawny orange; cuticle friable, darker than the scapus; physa transparent, with a very slight pinkish tint; capitulum pinkish, closely speckled with minute white spots, and œsophagus shines through, of a madder colour; madder-brown ring below the base of the tentacles interrupted by 16 short white lines, 8 of which correspond with the insertion of the mesenteries, and the other 8 are intermediate. Tentacles translucent, with numerous opaque, yellowish-white irregular spots and ring-like marks, and a smaller number of dark rings; tips pinkish. Disc, pale, flesh-colour, finely spotted with madder; circum oral chevron ring, also madder-coloured; a pair of dark madder spots about half way up each of the radii of the primary tentacles. Mouth linear, pale colour, on a small cone.

Dimensions.—Length, when extended, 48 mm.; average diameter, 3 mm.; expanse of tentacular crown, 17 mm.

Locality.—Berehaven; Bantry Bay, 10 faths., July, 16, 1886.

[Previous localities:—Weymouth; Brixham; Guernsey (Gosse). Is. Chansey, Manche (Quatrefages), St. Malo, Roscoff (Grube)].

Edwardsia carnea, Gosse.

(Plates xxxiii., fig. 15; xxxvi., figs. 5 & 6.)

Edwardsia carnea, n. sp., Gosse.	1856, Ann. Mag. Nat. Hist. (2), xviii., p. 219, pl. ix., figs. 1–4.
Edwardsia carnea, Gosse,	1858, *Ibid* (3), i., p. 418.
Edwardsia carnea, Gosse,	1860, Actin. Brit., p. 259, pl. vii., figs. 5, 6; pl. xii., fig. 8.
Edwardsia carnea, Hincks,	1861, Ann. Mag. Nat. Hist. (3), viii., p. 368.
Edwardsiella carnea, Andres,	1884, Le Attinie, p, 94.
Edwardsiella carnea, Pennington,	1885, Brit. Zooph., p. 178.

Localities.—Torquay, South Devon; Tenby, South Wales (Gosse).

I am indebted to Mr. G. Y. Dixon for permission to publish the following memorandum on this species:—

"*April* 24, 1887.—I have been studying the *Edwardsia carnea* that I got at Babbacombe last week, and have come to the conclusion that it may most easily be distinguished from *E. timida* by ridges that may be seen on its capitulum. I have been able to observe them best when the animal is in the act of protruding its disc and tentacles. Then if you look vertically down on the animal, viewing it with a side light, you will see that each of the eight broad regions which make up the capitulum is raised into a ridge running down its median line parallel to the direction of the region itself. As the animal expands these ridges disappear, but they re-appear when it withdraws its disc and tentacles down into the capitulum. The shape of the capitulum, too, in *E. carnea*, is more barrel-shaped than in *E. timida;* the opposite sides of the capitulum in *E. timida* are always parallel, while those of *E. carnea* are swollen like the sides of a cask."

Mr. Dixon obtained a couple of specimens from Mr. Gosse's own locality at Petit Tor, near Torquay, and kindly gave me one, on which I have made a few anatomical notes (*vide* p. 331).

Edwardsia timida, Quatrefages.

(Plate XXXVI., fig. 3).

Edwardsia timida, n. sp., Quatrefages, .	1842, Ann. des Sci. Nat. (2), xviii., p. 70, pl. ii., fig. 1.
Edwardsia harassi, n. sp., Quatrefages, .	1842, *Ibid*, p. 71, pl. ii., fig. 2.
Edwardsiella harassi, Andres, . . .	1884, Le Attinie, p. 94.
Edwardsiella timida, Andres, . . .	1884, *Ibid*, p. 96.
Edwardsia timida, G. Y. Dixon, . .	1886, Proc. Roy. Dub. Soc. (N.S.), v., p. 100, pl. vi.

Prof. H. Milne Edwards (**1857**, p. 286), and M. Fischer (**1875**, p. 203), merely repeat M. de Quatrefage's description of these two species. Mr. G. Y. Dixon found an Edwardsia near Dublin, which he describes very carefully and fully, after an examination of eight specimens: these he regards as examples of *E. timida*, and at the same time he unites M. de Quatrefage's two species, in which I also agree with him. I may add that I have several times examined his specimens when alive, and am able to corroborate his statements and support his conclusions.

Localities.—Is. Chansey, Manche (Quatrefages); Malahide, Co. Dublin (Dixon).

Edwardsia tecta, n. sp.

(Plates XXXIII., fig. 16; XXXVI., figs. 1 & 2).

Form.—Column elongated, thin; divided into physa, scapus, and capitulum; physa small, delicate, completely retractile within the scapus; no terminal pore can be detected in sections made through the apex of the physa; scapus smooth, with eight shallow longitudinal grooves, and without tubercles. The investment is thin, wrinkled, translucent, and in preserved specimens quite loose, forming a "membranous" tube within which the animal is withdrawn. Capitulum delicate, completely rectractile; tentacles eight in number, in the single specimen examined.

Colour.—No accurate notes were taken of the living animal. The colouring was certainly inconspicuous; my belief is it was of a dirty-white colour, with the disc and tentacles variegated with pale brown. Colour in preserved specimens dirty yellowish-grey

Dimensions.—Contracted specimen 12 mm. long; 2 mm. diameter.

Locality.—Nymph Bank, 52 faths., 28 miles south-west of Ballycotton, Co. Cork; and 70–80 faths., 5–8 miles west of the Great Skellig, off Co. Kerry.

Two specimens of this inconspicuous Edwardsia were examined; it is certainly distinct from any other British example of the genus, and, so far as I can gather from the published accounts, equally distinguishable from other described forms.

The ectoderm of the retractable portion of the anterior extremity of the column, the capitulum, and of the tentacles, consists of a layer of tall, ciliated, columnar cells, with distinct nuclei; the bases of those of the latter form a slightly pleated sheath of longitudinal muscle fibres. Nematocysts are also present in the ectoderm of the tentacles. The ectoderm of the scapus consists of shorter cells than the foregoing, and their nuclei are more rounded; they too are ciliated. The cells are very granular, but their basal portion is clear, and contains numerous deeply staining nuclei, which are much smaller than the nuclei of the epithelial cells. They appear, however, only to occur in the extreme anterior region of the scapus. Similar nuclei occur also in the ectoderm of the œsophagus and in the mesenterial filaments.

In the lower portion of the scapus the cells change somewhat in character; large round nuclei, which are also found higher up, are more abundant: they probably belong to the cells which secrete the investment. The ectoderm cells of the œsophagus are very narrow; those lining the œsophageal groove are shorter and possess very long cilia; the œsophageal ectoderm is ciliated, possesses numerous nematocysts and glandular cells; deeply staining nuclei are extremely abundant.

The endoderm does not call for special attention; scattered about are deeply staining masses, which are possibly glandular. The mesenterial filaments contain gland cells in their upper portion only; nematocysts occur as usual.

The mesoglœa is very clear; in the body-wall it often contains foreign bodies, which have become included by pressure from without.

The folds of the longitudinal retractor muscles of the mesenteries have a remarkably leaf- or moss-like appearance. The folds are about ten in number, either not at all or but very slightly forked, with the exception of the proximal fold, which is large and branched in a manner which recalls a deer's antler. The small proximal longitudinal muscle of the mesentery has a few moderately long folds at right angles to its length, and which may be slightly bifurcated.

In addition to the external differential characters which have already been enumerated, it is possible to distinguish the various species of Edwardsia by anatomical methods—at least such is the case for all the species I have been able to examine. Unfortunately, as most of my material has not been sufficiently well preserved, I am unable to give as precise an account as I should wish.

At present I can only speak definitely for the longitudinal retractor muscle of the mesentery, and more especially for the small longitudinal muscle which is present at the proximal extremities of the mesenteries. As the folds of this endodermic muscle occur on each side of supporting lamina of the mesentery they give a tree-like appearance to the muscle. I will refer to it as the parietal muscle.

In *Edwardsia tecta* (Pl. XXXVI., fig. 2) the folds of the parietal muscle are about half-a-dozen in number on each side, rather thick, of moderate length, and several are more or less divided.

In *E. beautempsii* (Pl. XXXVI., fig. 4) the folds of the parietal muscle number about a dozen on each side; they are relatively longer, and much more slender than in the former species, and exhibit very little tendency to divide. There are remarkable spaces in the mesoglœa of the body-wall, apparently filled with some non-staining, coaguable fluid. These spaces open to the ectoderm by raised conical orifices; the ectoderm is also raised up over them, but I cannot find any opening to the exterior. The pockets do not appear to be invaginations of the ectoderm, as I cannot distinguish any epithelial lining; the neck of the crater seems to be plugged by ectodermal cells, the peripheral cuticle of which is entire. They occur in the intervals between the mesenteries at the posterior end of the column. We must await other and better preserved material before coming to a conclusion as to their nature.

In *E. carnea* (Pl. XXXVI., figs. 5, 6) there are some half-a-dozen short thick folds of the parietal muscle rarely, and then but slightly bifurcate. The longitudinal retractor muscle consists of a few (eight to ten or so) slightly branched folds. The only specimen at my command cut very badly; so I am unable to give further histological details.

In *E. timida* the parietal muscle bears some resemblance to that of *E. beautempsii*, but it is relatively smaller, and the mesoglœa of the proximal portion of the mesentery is thinner; in the latter species there is a lateral thickening and extension of the mesoglœa, which gives a characteristic arrow-head appearance to it in transverse section. In the present species the lateral folds are about ten in number, and may be slightly divided; the proximal fold is usually complicated. The rectractor muscle of the mesentery is very large and pear-shaped in section; the character of the folds can best be understood by a reference to the figure (Pl. XXXVI., fig. 3). The specimen examined was a male.

OTHER DESCRIBED BRITISH EDWARDSIA :—

Edwardsia allmani, n. sp., M'Intosh,	1865, Proc. Roy. Soc. Edinb., p. 394; Marine Invert. Fauna, St. Andrews, p. 37, pl. ii., fig. 3; pl. vii., figs. 1–4.
Edwardsia goodsiri, n. sp., M'Intosh,	1865, *l. c.*, p. 395; *l. c.*, p. 38, pl. ii., fig. 4; pl. vii., figs. 5–7.

Locality for both of above, Saint Andrews.

On p. 262 of the "Actinologia," Mr. Gosse records the capture of an Edwardsia by Canon Kingsley at Torquay, which he (Gosse) thinks is referrible to *E. beautempsii*, Quatref. I have already stated my belief that *E. callimorpha*, Gosse, is that species. What then is this other form? The following is all the description we have of it. While generally agreeing with *E. callimorpha* in size and form, it differed in the following points:—1. The scapus was less opaque, more smooth and lubricous, and studded with longitudinal rows of minute warts between the invections. 2. The capitulum was clavate, proportionately longer, and of the same colour as the scapus, a pale pinkish-buff, or light orange. 3. The tentacles were fourteen in number, slightly uncinate or incurved, banded with dark buff. 4. The disc was transparent and colourless, with a dark protruded mouth.

In the above particulars this Edwardsia agrees so well with the description and beautiful figures of *E. claparedii* (Panc.) given by Professor Andres ("Le Attinie," p. 90; pl. xi., pp. 1-5), that we may with justice, for the present, allocate it to that species.

The following immature forms of British Edwardsia have been described:—*E. microps*, Andres (Gosse), S. Devon (*c. f.* Gosse, "Actinologia," p. 252, and Andres, "Le Attinie," p. 97); and *E. sp. incert.*, Dublin Bay (A. C. Haddon, **1886**, p. 527).

HALCAMPIDÆ (not of Andres).

Elongated Actiniæ, with a vesicular base; six pairs of perfect mesenteries present, including two pairs of directives; small imperfect mesenteries may be absent or present in all or in some of the exocœles; reproductive organs present on all the mesenteries, or absent only on the sulcular directive mesenteries; tentacles simple, usually twelve in number, but may be twenty or twenty-four; one or two œsophageal (gonidial) grooves present or absent.

Mr. Gosse (**1860**, p. 227) erected the family Ilyanthidæ to include Ilyanthus, Peachia, Halcampa, Edwardsia, Arachnactis, Cerianthus, and Saccanthus. Prof. Verrill (**1864**, p. 26) excluded the Cerianthidæ. Profs. Allman (**1872**, p. 394),

O. and R. Hertwig (**1879**, p. 124), and Andres (**1880 A**, p. 123) further detached Edwardsia. Prof. R. Hertwig (**1882**, p. 92) still includes Ilyanthus, Peachia, and Halcampa in the family, but Prof. Andres (**1884**, p. 240) confines the Ilyanthidæ to the genus Ilyanthus, the other two genera being types respectively of the Siphonactinidæ and Halcampidæ.

I have framed the above definition so as to include Peachia as well as Halcampa and Halcampella, for they appear in many respects to be allied genera; but Peachia may prove to be sufficiently distinct to necessitate a family of its own. Till we have an account of the anatomy of Ilyanthus, it hardly appears wise to associate it with the other forms.

Halcampa is the type genus of the family Halcampidæ. Halcampella (Andres, **1883**, p. 103) appears to differ solely in the fact that there are twenty-four tentacles. Three species of Halcampa (*H. albida*, Ag., *H. producta*, Stimps., *H. capensis*, Verr.) have been described as possessing twenty tentacles; the two former (if they are distinct) have twenty longitudinal sulcations, evidently corresponding to the insertion of the mesenteries. The more typical species of Halcampa may have only six pairs of perfect mesenteries (*H. clavus* of R. Hertwig), or there may be six pairs of imperfect mesenteries, one pair in each exocœle, as in the British species. In Peachia, however (*vide* page 338), there are twenty mesenteries, six pairs of perfect mesenteries, and four pairs of imperfect mesenteries; but in this genus there are only twelve tentacles. Possibly the three species first mentioned may prove to belong to a genus intermediate between Halcampella and Peachia. The other recorded apparent anomaly in the number of tentacles has already been referred to (p. 332); for *H. microps* (Gosse) is almost certainly an immature Edwardsia.

BRITISH GENERA OF THE FAMILY HALCAMPIDÆ.

HALCAMPA, Gosse. PEACHIA, Gosse.

HALCAMPA, Gosse, 1858.

Halcampidæ, with elongated vermiform body, divisible into capitulum, scapus, and physa; the capitulum is retractile; no sharply-defined circular muscle; œsophageal grooves present or absent; tentacles twelve in number (? twenty in some species); physa perforated by about twenty-four apertures at its apex; six pairs of imperfect mesenteries present or absent (? four pairs in some species).

The adult Halcampa is a truly hexamerous Actinian; but Dr. R. Hertwig, in describing a form he identified as *Halcampa clavus* (Quoy and Gaimard) (**1882**,

p. 92), says it "is so clearly an intermediate form that I was for long dubious whether I should treat of it under the Edwardsiæ or Hexactiniæ." The reason for this statement is found on p. 95, where he states: "As I was preparing a series of sections through the one half of the physa of the larger specimen, it struck me that three septa [mesenteries] (including the pair of directive septa) were not so strong as the other septa, inasmuch as their longitudinal muscular cords became sooner indistinct (pl. xiii., fig. 7). In the second smaller Halcampa, in which I was able to make sections through the entire body, four septa were somewhat smaller than the eight others." Prof. Hertwig then alludes to *Halcampa fultoni*, but reverses Dr. Strethill Wright's account. The latter said, "Eight septa were continued downwards to the lower extremity of the body, and had their free edges bordered by a convoluted ciliated band, furnished with cnidæ, or thread cells; the intersepta (*i.e.* the four smaller mesenteries) bore no convoluted bands (Ann. Mag. Nat. Hist. (3), viii., 1861, p. 132). Dr. Hertwig goes on to say: "All this shows that an unequal development of the septa, and consequently a difference in their morphological value, is not unusual in Halcampa. If we assume that the eight stronger septa are homologous with the septa of Edwardsia, whilst the four other septa are new formations, then the genus Halcampa would present us with transition forms between the Edwardsia and the Hexactiniæ" (*l. c.*, p. 95).

I have recently demonstrated (**1887**, p. 473) that the eight stronger mesenteries of the parastic larva, in *Halcampa chrysanthellum* are homologous with the eight mesenteries of Edwardsia, and that not only in this respect, but also in the presence of only eight tentacles, the larval Halcampa approaches the Edwardsiæ. There can be no doubt that Dr. Strethill Wright examined an older larva of *H. chrysanthellum* than I obtained, as his specimen had twelve tentacles. On referring to the rough diagram given in the paper quoted above, I find that his four "intersepta" correspond with the four weak mesenteries which I have figured (*l. c.*, **1887**, pl. xi., figs 6-8). It is unfortunate that Prof. R. Hertwig gives us no information as to which of the mesenteries are stronger or weaker in his smaller specimen; probably they correspond to the sulcar elements of the lateral pairs. His account of the mesenteries of the larger specimen does not inform us as to which of the mesenteries are imperfect in addition to the pair of directives, the only clue we have is his fig. 7, pl. xiii. The section includes a single large mesentery on one side of the small directives, on the other side are two large mesenteries with a small one between them. From their behaviour in the British species of Halcampa, it is fair to assume that these are the sulcular directive mesenteries: the other weak mesentery would correspond with the sulcar member of the sulculo-lateral pair. If the remaining half followed the usual arrangement in the genus, the mesenteries in this species would resemble in the main those of the lower portion of the body of *H. chrysanthellum.*

BRITISH SPECIES OF HALCAMPA.

HALCAMPA CHRYSANTHELLUM (Peach).
„ ARENAREA, Haddon.
„ CLAVUS, Hertwig.

Halcampa chrysanthellum (Peach).

(Plates XXXV., figs. 1 and 2; XXXVI., fig. 7.)

Having a short time ago (**1886**, p. 1) critically discussed this species, there is no need to repeat the bibliography there given. I find, however, that two synonyms have been omitted from the bibliography (*l. c.* page 2): *Actinia chrysanthellum* should be inserted opposite to "Cocks, 1851," and *Halcampa chrysanthellum* opposite to "Gosse, 1860." The „ „ marks which follow will then be correct. I have recently found that Prof. K. Möbius, in 1873, records *Edwardsia chrysanthellum*, from Kiel, 7-10 faths., mud; and from Bülk (near Kiel) 10½ faths., grey sandy mud and algæ: he now regards this as the correct specific name for *E. duodecimcirrata*, Sars, and of Meyer and Möbius.

From a note taken at the time this species appears to occur at Nymph Bank, Co. Cork, 52½ fathoms, but I cannot now find the specimen, so there may be some mistake in the identification; at all events the parasitic larval form was collected by the tow net in Ballycotton Bay, Co. Cork, the previous night. Having recently (**1887**, pp. 473-481; pl. xi.) given an account of the parasitic larva of this species, nothing more need here be said.

Halcampa arenarea, Haddon.

(Plates XXXII. fig. 5; XXXIII., fig. 14; XXXV., fig. 3; XXXVI., figs. 8–10.

Halcampa arenarea, n. sp., Haddon, . . 1886, Proc. Roy. Irish. Acad. (2), iv., Sci., p. 616. (The specific name was erroneously printed "*arenacea*.")

Form.—Column divided into capitulum, scapus, and physa; physa smaller, globular, apparently without suckers, completely retractile; scapus cylindrical, even when extended, very contractile, provided with numerous long permanent suckers, which adhere to grains of sand; capitulum cylindrical when fully extended, completely retractile. Tentacles—twelve, marginal, monocyclic, cylindrical, obtuse, about as long as diameter of disc, usually so carried that the endocœlic tentacles point forwards, the exocœlic being recurved.

Disc.—Flat; mouth linear.

Colour.—Physa transparent, almost colourless; scapus a dull, pale, madder brown; capitulum translucent, dirty, flesh-colour: tentacles of same colour as the capitulum, with four imperfect very pale-brown marks, and an M-shaped mark, at the base of which the vertical limbs are situated on the sides of the tentacles; disc of same pale flesh-colour; the twelve mesenteries appear as pale radiating lines; at the base of each tentacle is a pair of narrow, wedge-shaped, pale-brown marks, the apices of which point towards the mouth; between these and the mouth is a lenticular pale-brown spot, which, with its fellows, form a ring round the mouth, and separated from it by a short interval. Mouth brownish.

In another specimen the markings of the disc and tentacles were much less distinct than in the former specimen; the axial line of the disc and the axial tentacles were decidedly bleached, and the capitulum was translucent white, with white bands.

Dimensions.—Length about 35 mm.; in the ordinary condition it can contract to about 18 mm.; diameter variable, average about 7 mm.

Habitat.—South-west of Ireland, sand; mouth of Kenmare River, 38–44 faths. (1885); mouth of Bantry Bay, 38 faths. (1886).

Halcampa clavus, R. Hertwig.

There is a record of a third British species of Halcampa which requires further elucidation. On p. 674 of Capt. Tizard and Dr. J. Murray's paper on the "Exploration of the Faroe Channel, during the summer of 1880, in H. M. S. (hired ship) 'Knight Errant,'" (Proc. Roy. Soc. Edinburgh, Session 1881–82, vol. xi.), *Halcampa clavas* is recorded from sounding 17, Station 2, lat. 60° 29′ N., long. 8° 19′ E., July 28, 375 faths., bottom temperature, 31°·0; that is, from the northern (cold area) declivity of Wyville Thomson Ridge in Faroe Channel. Dr. Murray informs me by letter that this specimen was identified by Dr. R. Hertwig. In his "Challenger" Report, p. 92, Prof. Hertwig describes as *Halcampa clavus* an Actinian dredged at Kerguelen (25-120 faths.) It is difficult to understand why Dr. Hertwig did not adopt *H. purpurea*, Studer (**1878**, p. 545), as the name of this species. Dr. Studer's specimens were obtained from the same locality as those dredged by the "Challenger." This may or may not be identical with the *Actinia clavus* of Quoy and Gaimard, which the French naturalists found attached to a Medusa in Bass' Straits; but it appears to be extremely improbable that an antarctic species of Halcampa should reappear in the cold area of the Faroe Channel, I can only conclude that Prof. Hertwig was struck by a superficial resemblance, and named the specimen before he had made any anatomical investigation of it.

As Dr. Andres points out (**1884**, p. 97), *Halcampa microps*, Gosse (*cf.* "Actinologia," p. 252), is an immature Edwardsia, and he renames it *E. microps*.

A comparison of the figures on Plates XXXV. and XXXVI. will at once demonstrate that it is perfectly easy to distinguish between the two British species of Halcampa from transverse sections alone. The following are the most obvious differences:—

1. The œsophagus in section is relatively to the diameter of the body very much larger in *H. chrysanthellum* than it is in *H. arenarea* (Pl. XXXV., figs. 1 & 3).

2. The marked difference in the pattern of the folds of the muscular epithelium in the longitudinal muscles of the mesenteries. In *H. chrysanthellum* the folds average ten or eleven in number, and are more open in character than in *H. arenarea:* in the latter species there are usually some fifteen or so.

3. In *H. chrysanthellum* only six mesenteries bear generative products, these being the pair of sulcar directives, and the two sulcular mesenteries of the perfect lateral pairs; the sulcular directives and the sulcar mesenteries of the perfect lateral pairs being sterile (Pl. XXXV., fig. 2). All twelve mesenteries are fertile in *H. arenarea*, apparently to an equal extent.

4. Suckers formed by outgrowths of the middle layer, coated by the ectoderm, occur in *H. arenarea* (Pl. XXXVI., fig. 9), but are absent in the other species.

Other less marked distinctions can be discovered on submitting the various organs and tissues to a rigorous examination.

PEACHIA, Gosse, 1855.

Halcampidæ, with column divisible into capitulum, scapus, and physa; column provided with numerous minute suckers; the capitulum retractile; no sharply defined circular muscle; a single deep œsophageal groove, which is continued as a tube to nearly the posterior end of the body; its oral end is produced into well-marked, often complicated, lobes (the conchula), of which one basal and two lateral elements can always be detected; tentacles twelve; physa perforated by very numerous apertures in twelve longitudinal rows; four pairs of short, sterile mesenteries present, in addition to the six pairs of perfect fertile mesenteries, situated in the lateral and sulcar exocœles; longitudinal muscles of all the mesenteries extremely well developed.

BRITISH SPECIES OF PEACHIA.

PEACHIA HASTATA, Gosse.
(„ UNDATA (?), Gosse). (Probably immature form of above.)
(„ TRIPHYLLA, Gosse).

The last two species have hitherto only been recorded from the Channel Islands.

Peachia hastata (Gosse).

This form occurs abundantly in a limited district in Dublin Bay. Mr. G. Y. Dixon and myself have given (A. C. Haddon and G. Y. Dixon, **1885**, p. 399) a short account of the history and habits of this interesting Actinian. The only accounts we have of its structure are—(1) a short notice by M. Faurot (**1884**, p. 756), and an allusion to the œsophageal groove by Mr. Sedgwick (**1884**, p. 84), who gives the only published figure (pl. ii., fig. 6) of any anatomical details. The figure represents an internal view of the upper portion of a partially dissected Peachia (sp. not stated).

The accompanying diagram represents the arrangement of the mesenteries and the general appearance of their enormously developed longitudinal muscles.

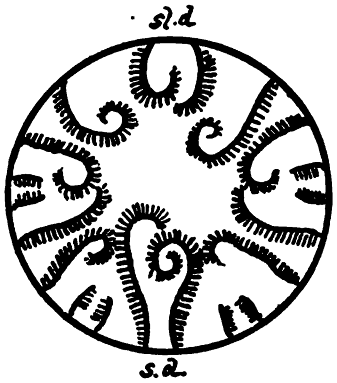

FIG. 1.—Diagrammatic section through *Peachia hastata*.

There are six pairs of perfect (*i. e.* those which reach the œsophagus) mesenteries arranged in the ordinary manner. In each lateral and sulco-lateral exocœle (inter-mesenteric chamber) there is a pair of small imperfect mesenteries, these also possess relatively very large longitudinal retractor muscles. Of the twelve perfect mesenteries, the sulcar directives are much larger than the others, and in the upper portion of the body, below the œsophagus, bear the ciliated groove. The sulcular directives appear to be smaller than the four pairs of lateral mesenteries. All the perfect mesenteries are fertile.

On a future occasion I hope to have more to say on this very interesting Actinian, but I may here remark, that I have a sketch of a conchula of a specimen not fully grown, which is practically identical with the woodcut Mr. Gosse gives ("Actinologia," p. 239) of his *P. undata*, and I am inclined to believe that the latter is but a half-grown *P. hastata*.

Several larval Actiniæ, together with the Leptomedusæ, on which they were parasitic, were given to me by my friend, Prof. W. C. M'Intosh, who obtained them at St. Andrew's, Fife, Scotland, in 1887. The Actiniæ attach themselves to the upper or under surface of the bell, or to the margin, or to the gastric region of the Medusæ. (M'Intosh, **1887**.)

The Actiniæ from St. Andrew's are of slightly different ages: the youngest so exactly corresponds to the stage of *Halcampa chrysanthellum* previously described by me (**1887**, p. 473), that a further description would be superfluous. The slightly older larvæ are larger, the tentacles are longer, and new tentacles are making their appearance in the lateral endocœles. I am not yet in a position to state whether there is any particular order in their development.

At first sight these young Actiniæ bear an unmistakable resemblance to the larvæ of *Halcampa chrysanthellum* both externally and anatomically; so we may confidently consider them to be closely allied. The presence of twelve mesenteries precludes their being Edwardsiæ. The genera Peachia and Ilyanthus are usually associated with Halcampa: of the second of these I can say nothing, as it has never been anatomically described; besides, it is quite a rare form; but our larvæ are decidedly common. We then narrow the question to Halcampa and Peachia. Only two British species of Halcampa are known—*H. chrysanthellum* of North European distribution, and *H. arenarea* (*ante*, p. 335) from the south-west of Ireland. Of this only two specimens have been obtained. I have made sections through three parasitic larvæ of *H. chrysanthellum*, and am therefore well acquainted with it, and, although they agree perfectly with the forms from St. Andrew's in their general appearance and structure, still there are distinctions in their histology which cannot now be gone into. One point, however, deserves special mention, and that is the appearance of the longitudinal retractor muscle of the larger mesenteries. In the earlier stages of *H. chrysanthellum* the muscle is relatively more extended than in the adult, but the distal plications are of considerable length, and decidedly recall those of the adult. In a later stage this is naturally still more marked. The corresponding muscles in the St. Andrew's specimens is much less conspicuous; it extends for a greater distance across the mesentery, consequently the plications are more numerous, but, on the other hand, they are very much shorter and simpler than in *H. chrysanthellum*.

In transverse sections through *Peachia hastata* I find that the retractor muscles are greatly developed, forming a regular close-set fringe to the border of the mesentery, and thus constituting a type of muscle very different from the reniform section of the retractor in Halcampa. My material is at present insufficient to enable me to make a definite statement, but there is nothing in the character of the longitudinal muscles of the mesenteries antagonistic to the view that these are the young of *Peachia hastata*. The latter species, according to Prof. W. C. M'Intosh, is common in the neighbourhood. I would further point out that the larvæ from St. Andrew's, stage for stage, are decidedly larger than those of the Halcampa which occurred to me: this would also correspond with the greater size of the adult Peachia over that of Halcampa.

A preliminary account of the above, with rough diagrams, has recently been published by myself (**1888** (A), p. 281; (B), p. 256).

The localities for *P. hastata* are—north of France, south of England, east of Ireland, and east of Scotland. The unique specimen of *P. undata* came from Herm, Channel Islands.

The remaining British species is *Peachia triphylla*, Gosse (*cf.* Gosse, Actinologia, p. 243, and Andres, Le Attinie, p. 109).

Actinia cylindrica, Reid (**1848**, Ann. Mag. Nat. Hist. (N.S.), I., p. 34), was called *Peachia cylindrica* by Mr. Gosse ("Actinologia," p. 245), and *Halcampa cylindrica* by Dr. Andres ("Le Attinie," p. 105). Mr. G. Y. Dixon and myself (**1885**, p. 400) have discussed its identity with *P. hastata*. As *A. cylindrica* was at the time pre-occupied, Mr. Gosse's name stands.

The synonymy of the Actiniæ which are found parasitic on various Medusæ, and which have been referred to the genera Bicidium, Philomedusa, Halcampa, and Peachia, has recently been discussed by me (**1887**, p. 473), and need not be here repeated.

Ilyanthus.

I have no knowledge of this genus.

GONACTINIA.

Although not recorded as British, I propose to give a brief account of *Gonactinia prolifera*, Sars, as it appears to constitute an interesting link in the series of forms we are now considering.

Gonactinia prolifera, Sars.

Actinia prolifera, n. sp., M. Sars, . .	1835, Beskrivelser og Jagttagelser over nogle mærkelige eller nye i Havet ved den Bergenske Kyst levende Dyr, &c., Bergen, pp. 3, 11, pl. ii., fig. 6.
Gonactinia prolifera, M. Sars, . . .	1851, Nyt. Mag. f. Naturvid., vi., p. 142.
Gonactinia prolifera, Koren, . . .	1859, Nyt. Mag. f. Naturvid, ix., p. 93.
Gonactinia prolifera, Andres, . . .	1884, Le Attinie, p. 362.
Gonactinia prolifera, Blochmann and Hilger,	1888, Morph. Jahrb., xiii., p. 385, pls. xiv. and xv.

Habitat.—Coasts of Norway, from 2 to 20 faths.

Very recently Drs. Blochmann and Hilger (**1888**) have given a careful anatomical description of *Gonactinia prolifera*, Sars, and of its remarkable anular method of reproduction by means of transverse fission or strobilisation. These authors find that there are sixteen mesenteries, eight of which reach the œsophagus ("macrosepta"), and the other eight do not ("microsepta"). Two pairs of directive mesenteries are present. Starting from what they identify as the dorsal (sulcular) directives, there are on each side a pair of microsepta. (?) Then follows a macroseptum, which, below the œsophagus, bears the "generative organs;" then a microseptum; next again a "fertile" macroseptum, followed by a microseptum; and lastly, there are the two sulcar ("ventral") directives.

The longitudinal, or retractor, muscles of the mesenteries are arranged in such a manner that the two microsepta on each side of the dorsal directives form a pair: two other pairs are formed by a macroseptum and a microseptum respectively. The accompanying diagram illustrates these facts.

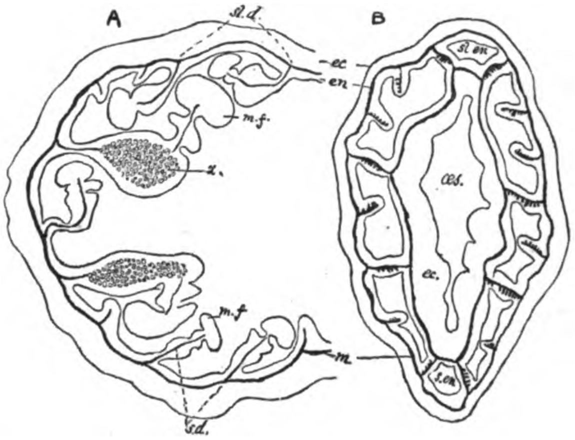

FIG. 2.—*Gonactinia prolifera* (after Blochman and Hilger).
A, half a transverse section below the œsophagus; B, transverse section through the œsophageal region.
(For lettering, see explanation of Plate xxxiv.)

Two œsophageal grooves are present. There are sixteen tentacles in two rows of eight each. "Septalstomata" or perforations in the mesentery appear to be absent. Acontia are also wanting. Length when extended 5 mm.

Drs. Blochmann and Hilger point out that we have in Gonactinia two mesenterial systems which may be compared together, but are inversely orientated. The one consists only of macrosepta, the other solely of microsepta. Each of them exhibits, in its own disposition of muscles, that which one finds in the Edwardsiæ. Later on they state that this Actinian cannot be placed in Prof. R. Hertwig's system ("Challenger" Report). Perhaps it had better be ranged near the Zoantheæ; it agrees with these in the presence of partition walls of two kinds, but is sharply separated from them by the possession of two œsophageal grooves. At all events a new tribe must be erected for it.

These authors' comparison of the mesenteries of Gonactinia with those of Edwardsia calls for remark. The agreement of the "macrosepta" with the mesenteries of Edwardsia is suggestive, but nothing appears to be gained by turning the animal round and seeing a similar agreement in the "microsepta."

I would rather suggest a comparison with the arrangement of the mesenteries which obtains in the young of several other Actiniæ (see p. 350). By comparing a diagram of the latter (Pl. XXXVII., fig. 7) with the one of Gonactinia (p. 341, fig. 2) it will be seen that there are only two points of difference—(1) the Halcampa larva has only one œsophageal groove (the ventral), and (2) the addition of a pair of weak mesenteries (microsepta) on each side of the pair of dorsal directive mesenteries. The lateral strong mesenteries in Gonactinia are alone "fertile," in *Halcampa chrysanthellum* (Pl. XXXV., fig. 1) these, with the ventral directive mesenteries, bear the gonads. It is questionable whether the possession of a mesenteric filament by the weak mesentery, between the two "fertile" mesenteries in Gonactinia, is of any special significance.

A pair of very small secondary imperfect mesenteries occur in the intermesenterial chambers of *Halcampa chrysanthellum* and *H. arenarea*, as in most other Actiniæ, but not in *H. clavus* (R. Hert., (?) of Q. & G.). The sulculo-lateral pairs of similar mesenteries in Gonactinia may for the present be regarded as being the equivalent of these, but of which only two pairs are developed. We have just seen that in *Peachia hastata* the lateral and sulco-lateral pairs of imperfect septa are alone present, so the occurrence of only sulculo-lateral pairs is not very anomalous. The only unique feature in this Actinian is the faculty of a sexual reproduction by means of transverse fission.

It will be seen from the above that I have mentioned the presence of generative organs in Gonactinia with doubt. An inspection of figure 2 will show that the character of what have been identified as the testes is very different from the testes as figured by the Brothers Hertwig, or in the accompanying plates (Pl. XXXV., figs. 2 & 6; Pl. XXXVI., fig. 7); and indeed from any Actinian generative organ with which I am acquainted. These bodies, however, are so similar in appearance and size to the commensal unicellular algæ (Zooxanthellæ), that Drs. Blochmann and Hilger must adduce conclusive evidence of their sexual nature before their view can be accepted. It is not unusual to find the algæ crowded in the same four mesenteries of the young of *Cereus pedunculatus* in the stage corresponding to that of the figured Gonactinia.

The minute size of Gonactinia is suggestive of immaturity, as adult Actiniæ are rarely very small. The arrangement of the mesenteries, as will be seen from what follows, also supports the view, that this may after all be an immature form: this is also confirmed by the character of its histology and the feeble development of the mesoglœa.

I am not prepared to say of what form Gonactinia is probably a larval stage, but would venture to suggest an investigation of the development of *Anemonia sulcata* (Penn.) = (*Anthea cereus*, Auct.), and of *Actinopsis flava* (Dan. & Kor.), the young forms of which are undescribed. An anatomical investigation of the latter species would be particularly interesting.

ZOANTHEÆ.

Actiniæ, with numerous perfect and imperfect mesenteries; two pairs of directive mesenteries, of which the sulcar are perfect and the sulcular are imperfect. A pair of mesenteries occur on each side of the sulcular directives, of which the sulcular moiety is perfect and its sulcar complement is imperfect; a similar second pair occurs in one section of the group (Zoanthus), or the second pair may be composed of two perfect mesenteries (Epizoanthus). In all the remaining pairs of mesenteries this order is reversed, so that the perfect mesentery is sulcar and the imperfect sulcular. The latter series of mesenteries are bilateral, and arise independently (*i.e.* neither in pairs nor symmetrically on each side) in the exocœle on each side of the sulcar directives, in such a manner that the sulcular are the oldest and the sulcar are the youngest. The perfect mesenteries are alone fertile. A single sulcar œsophageal groove is present. Animals usually forming colonies; body-wall usually traversed by irregularly-branching ectodermal canals, and rendered rigid by grains of sand.

Prof. Dana (**1846**), and later, Dr. Andres (**1877**), and the Brothers Hertwig (**1879**), showed that the mesenteries of the Zoantheæ were arranged on a different plan from those of other Actiniæ, and demonstrated the occurrence of alternate perfect and imperfect mesenteries; but Prof. von Koch (**1880**) was the first to elucidate this arrangement in *Zoanthus* (*Palythoa*) *axinellæ*. Prof. R. Hertwig's "Challenger" Report was published in 1882, and threw much further light upon the anatomy of the Zoantheæ. Shortly afterwards Dr. G. Müller (**1883**) published his dissertation, in which he more or less fully describes fourteen species of Palythoa and Zoanthus. The last Paper on the subject is one by Dr. A. Erdmann (**1885**).

In this very important Paper Dr. Erdmann describes two species of Zoanthus, five species of Epizoanthus, three species of Palythoa, two species of Corticifera, one of Sphenopus, and an unnamed new genus: of these fourteen species only one, *Palythoa axinellæ*, Schmidt, is fully identified. The main facts relating to the arrangement of the mesenteries are as follows:—

Two kinds of mesenteries are present in the Zoantheæ—

1. Larger, or "macrosepta," bearing mesenterial filaments and generative

organs, which reach the œsophagus throughout its entire length, and are therefore "perfect."

2. Smaller, or "microsepta," without mesenterial filaments and generative organs, which, not reaching the œsophagus, are "imperfect."

A macroseptum and a microseptum together constitute a pair of mesenteries, as the sides which face each other bear a longitudinal muscle. Only two pairs form an exception, these are the pairs of directive mesenteries, situated one at each of the long axis of the œsophagus, and whose longitudinal muscles are on opposite sides of the mesenteries.

The œsophagus possesses but one œsophageal groove, the directive mesenteries of this pole being macrosepta, whereas those of the opposite side are microsepta.

In Zoanthus the pairs of mesenteries are arranged in two series—(*a*), on each side of the micro-directive mesenteries, and starting from them the first two pairs consist each first of a macroseptum and then of a microseptum; (*b*), the third and succeeding pairs each consist first of a microseptum, and then of a macroseptum, thus the pair of macro-directive mesenteries lie between two macrosepta. In Epizoanthus the arrangement is the same, except that the second pair of mesenteries is composed of two macrosepta, instead of a macroseptum and a microseptum. (See Diagrams, Pl. XXXVII., figs. 1 & 2.) Thus, in addition to the bilateral symmetry, which is discernible in all the Actiniæ, although superficially they appear to have a typical radial symmetry, we have in the Zoantheæ a division line at right angles to the sagittal axis, which demarcates the regions of the pairs of mesenteries just alluded to.

Prof. R. Hertwig has termed the micro-directive mesenteries "dorsal," and the macro-directives "ventral," and in this he is followed by Dr. Erdmann. As the former zoologist says, "We can therefore divide the ordinary pairs of 'septa' (mesenteries) into two different regions; in the one (the larger or ventral region) the ventral septa of the single pairs are macrosepta, and the dorsal septa are microsepta, whilst in the other (the dorsal region) the reverse is the case, and the dorsal septa are macrosepta" ("Challenger" Report, p. 110).

From the foregoing description it will be seen that there are two types of arrangement—the one in which the sulcular ("dorsal") region is separated from the sulcar ("ventral") by two imperfect mesenteries (Pl. XXXVII., figs. 1 & 2); and the other in which the two regions are divided by two perfect mesenteries: the former type is termed by Dr. Erdmann the "microtypus," the latter the "macrotypus."

I object to use the terms "macro-" and "micro-septa," not only because they are hybrid words, but on account of the use of the word "septum," which, as I have previously stated, should be retained for the calcareous partitions of the corals. There is, moreover, no need to introduce a new term when we already possess the equivalent in "perfect" and "imperfect" mesenteries.

As Dr. Erdmann also points out, in Actiniæ the development of the mesenteries falls into two periods. The first, in which there are six perfect pairs, including the two pairs of directives. In the second period, in the majority of Actiniæ, the other mesenteries successively appear in pairs in the centre of each intermesenterial chamber (exocœle); but never in an intramesenterial chamber (endocœle). These constitute the mesenteries of the second, third, &c., order.

It is in the second period that the order of origin of the mesenteries is different in the Zoantheæ; for here the new mesenteries are formed only in the intermesenterial chambers which lie immediately on each side of the sulcar ("ventral") directive mesenteries. The perfect mesenteries and imperfect mesenteries are developed independently of each other, and not necessarily symmetrically. From this it follows that—taking the sulcar region into consideration only—the most sulcular mesenteries are the oldest; those nearest the sulcar directive are the youngest, the mesenteries appearing singly, and not in pairs, and, lastly, there may be more on one side than on the other (see Pl. XXXVII., fig. 3).

We may put this another way, by saying that in the majority of Actiniæ the new pairs of mesenteries appear radially in all the exocœles, whereas in the Zoantheæ they appear laterally in the sulcar exocœles.

At a very young stage, that is, in the first period, only the two pairs of directives, and the sulcular pairs of mesenteries are present, but the distinction noted above still obtains. (See diagrams, Pl. XXXVII., figs. 4 & 5). Dr. Erdmann terms these young stages, respectively, the "microgrundform," and the "macrogrundform."

We are justified in assuming that the sole distinction between these two types is, that in the "macrotypus" the second lateral perfect mesentery (that is, the sulcar element of the sulco-lateral pair of the ground-type) on each side has developed into a perfect mesentery. If this be so, Prof. Hertwig was mistaken in supposing that in this group two imperfect mesenteries are wanting between the sulculo-lateral pair of perfect mesenteries.

We are now in a position to discuss the probable relationships of the Zoantheæ. On comparing a diagrammatic section, through a young microtype form (*e. g.* Zoanthus) with a similar section through a larval Halcampa, we find an absolute identity in the disposition of the mesenteries, with the single exception of the sulcular directives, which are imperfect in the Zoantheæ, but perfect in Halcampa, although both in the young form and the adult they are perceptibly weaker than the other eight perfect mesenteries (diagrams, Pl. XXXVII., fig. 7, A & B). The sulcar œsophageal groove alone is present, and, lastly, in the adult, *H. chrysanthellum*, it is only those mesenteries which correspond with the perfect mesenteries of, say, Zoanthus, which are fertile, and it must be remembered that only the perfect mesenteries of the Zoantheæ are fertile.

Accepting the arrangement of the mesenteries as a clue to affinity, and, as a matter of fact, we have little else to guide us, we may safely assert the relationship of the young Zoantheæ with the young of several different forms of Actiniæ, as I shall show. The adults constitute a very distinct subdivision of the Actiniæ, owing to the unique method in which the new mesenteries make their appearance. The very general possession of ectodermal canals in the body-wall and of asexual reproduction by means of buds from a stolon serve to accentuate their distinctness.

I have not yet had time to sufficiently study the British species of Zoantheæ from an anatomical or from a synonymic point of view.

DEVELOPMENT OF ACTINIÆ.

With the exception of an important Paper by Prof. H. de Lacaze Duthiers (1872), very little has been done to elucidate the developmental history of Actiniæ. So far as they go the researches of the above author are most precise, and are illustrated by beautiful figures. The facts elucidated are very remarkable, and are not at all what would, *a priori*, be expected to occur in a hexamerous Actinian. The investigations mainly concern the order of appearance of the mesenteries and tentacles: the former will first occupy our attention.

Prof. de Lacaze Duthiers studied the following species:—*Actinia equina*, *Cereus vedunculatus* = (*Sagartia bellis*); *Cylista undata* = (*S. troglodytes*); and *Bunodes verrucosa* = (*B. gemmacea*).

The following brief abstract refers to the first species:—

Actinia equina.

1. The cavity (cœlenteron) of the larva is divided into two unequal chambers by two small mesenteries which arise transversely to the long axis of the œsophagus. The larger chamber will be referred to by *a′*, the smaller by *a* (Pl. XXXVII., fig. 8).

2. A second pair of mesenteries is next formed in the chamber *a′*, dividing it into a larger terminal chamber (*a′*), and a lateral small chamber (*b*) on either side (Pl. XXXVII., fig. 9).

3. In the next stage chamber *a* is similarly divided into a terminal chamber (*a*), and into a pair of lateral chambers (*c*). Following so closely upon this as to almost occur at the same time, the chamber *b* of each side is subdivided into *b* and *d* by the formation of mesentery No. 4 (Pl. XXXVII., fig. 10).

The first and second pairs of mesenteries to appear are also the first which reach the œsophagus: shortly later the third and fourth pairs also join (Pl. XXXVII., fig. 11).

4. The chambers *d* are next divided into *d* and *e* by No. 5 mesentery, and this is closely followed by the division of *c* into *c* and *f* by the 6th pair of mesenteries (Pl. XXXVII., fig. 12). These two new pairs of mesenteries are at first quite short, and do not possess the mesenterial filaments which characterise the other mesenteries. Of the latter, the first pair to appear still maintains its prominence by having very large craspeda: they were also the first mesenteries to obtain them (Pl. XXXVII., fig. 13).

Later, the fifth and sixth pairs of mesenteries reach the œsophagus, so that there are now twelve perfect mesenteries, which fall into the ordinary Actinian arrangement of two pairs of directives and two pairs of lateral mesenteries. It must be borne in mind, that in the description of the order of the mesenteries, the "pairs" spoken of merely referred to the synchronous appearance of two corresponding mesenteries on each side of the axial line, and not two pairs of complementary mesenteries.

At a later stage each exocœle is divided by a pair of mesenteries in the usual manner, but in a slightly older larva, figured by Prof. de Lacaze Duthiers, the two exocœles on each side of the axial endocœle *a′* have each originated a pair of small mesenteries.

Concerning the third stage in the order of appearance of the mesenteries, our author says (*l. c.*, p. 331): "One may see from the preceding paragraph, that it is difficult to establish the succession of the partitions of the third and fourth formation. It is only when they are well marked, that one can recognize that the one is more developed than the other. It results from this—an obviously very remarkable fact—that the period when the number six occurs is very quickly passed over, very fugitive . . . If then the period of four chambers is very evident and easy to establish, the period of the number of eight is not less so."

It is during the octoradiate stage that the tentacles first appear. The earliest to appear sprouts from the terminal chamber *a′*, and until the twelve-rayed stage has become well established this tentacle is markedly larger than the others. Of the remaining seven tentacles, those corresponding to the median lateral chambers (*d*) are next largest. The axial tentacle *a* and the other four tentacles are much smaller, being scarcely more than tubercles (Pl. XXXVII., fig. 14, A, B, & C).

In the next stage, the axial tentacles (*a′* and *a*) and the three central lateral ones (*d*, *e*, *f*) are large and of the same size, except *a′*, which is still the largest: the remaining four tentacles, corresponding to the exocœles on each side of the directives, remain rather small.

The order of development of the mesenterial filaments is as follows:—(1) The first pair of mesenteries; (2) the fourth pair; (3) the second and third pair practically simultaneously; (4) the fifth and sixth pairs of mesenteries acquire their craspeda somewhat later.

These three organs—mesenteries, tentacles, and craspeda—appear in pairs relative to the axis of the body, and not in the least corresponding to the paired radial symmetry of the adult. In other words, the early larva are bi-laterally symmetrical, and it is only on the completion of the stage with twelve perfect mesenteries that the young definitely acquires the radial symmetry of the adult. The tentacles, however, continue to develop in an apparently anomalous manner, which need not now detain us: on the completion of the number twenty-four they are arranged in the cycles typical of the Actiniæ, viz., 6 + 6 + 12. Another period of irregular appearance occurs, but when the forty-eight stage is established, the radial symmetry again becomes predominant, and we have 6 + 6 + 12 + 24. In this and in the preceding stage the tentacles do not appear in the order which their size or their cycle would indicate: thus we have the tentacles of a sextant arranged as follows:—

Cycle, . .	I.	IV.	III.	IV.	II.	IV.	III.	IV.	I.
Appear., .	1	4	4	3	3	2	4	4	1

The marginal spherules which characterise this species appear at the twelve-rayed stage.

The first two mesenteries to appear, that is those which primitively divided the embryo into moieties, can, by their size, be continued to be recognized, until the period when the young Actinia has twenty-four tentacles: thus it is possible up to this stage to recognize the elements dependent on each of the two primitive moieties.

Cereus pedunculatus (*Sagartia bellis*).

The formation of the mesenteries and tentacles in this form exactly recapitulates that of *Actinia equina.* At the stage of twenty-four tentacles, acontia are formed by the edges of the two mesenteries which first make their appearance, becoming detached and floating freely in the cœlenteron. As in the above example, the same mesenteries first acquire craspeda, very shortly afterwards the fourth pair also develop them. This preponderance of the first four filaments is early apparent, and persists until the twelve-rayed stage is passing away, when the directive mesenteries acquire their mesenterial filaments, which soon outstrip the others in size.

Cylista undata (*Sagartia troglodytes*).

The development of this Sagartid precisely resembles that of the foregoing.

Bunodes verrucosa (*B. gemmacea*).

The order of development of the mesenteries and tentacles is the same as above, but it appears that Bunodes remains longer in the octoradiate stage than the preceding species (Pl. XXXVII., fig. 15). As before, this number eight is decomposable into three and five, on account of the position of the first pair of mesenteries. The four new tentacles to complete the twelve arise from the chambers *c* and *e* (compare diagram, Pl. XXXVII., fig. 16).

The mesenterial filaments at first appear on the two oldest pairs of mesenteries, *i. e.* 1 and 2: later they occur on the mesenteries of the fourth age (Pl. XXXVII., fig. 16).

Professor A. Kowalevsky has published some observations on an undetermined species of Actinian. The first two mesenteries appear at the same time that the lips of the blastopore are invaginated, to form the œsophagus (stomatodæum). A pair of mesenteries then appear in each of the two chambers, into which the cœlenteron is divided by the first pair. So far the order agrees with that described above for *Actinia equina*, but instead of a pair of mesenteries arising laterally, an unpaired mesentery is formed in one axial chamber, and shortly afterwards one arises in the opposite axial chamber: thus a stage with eight mesenteries is also developed.

The Brothers Hertwig (**1879**) describe three stages in the development of *Adamsia diaphana*, the earliest of which already possessed twelve mesenteries (diagram, Pl. XXXVII., fig. 17, A & B). In their second stage the outer mesenteries of the four short lateral mesenteries have grown considerably, and developed their longitudinal muscles. They are now seen to be the complements of the four perfect lateral mesenteries, and later they too reach the œsophagus, and complete the six pairs of primary perfect mesenteries. In the last stage the pairs of mesenteries of the third and fourth cycle have appeared in the exocœles in the ordinary manner.

The only account we possess of the development of the mesenteries in Edwardsia is the preliminary publication of some drawings in the "Selections from Embryological Monographs" (**1884**), of an unpublished Paper by Dr. E. L. Mark. The form studied was, perhaps, *Edwardsia lineata*, Verr., which, in its earlier stages, is parasitic in the Ctenophore *Mnemiopsis leidyi*. Two mesenteries first appear: these are the sulco-lateral, or, according to the ordinarily received terminology, the ventro-lateral. The right sulco-lateral mesentery ends somewhat abruptly before reaching the aboral pole. In a transverse section made at an early stage depressions in the surface of the endoderm show the places where the mesenteries will appear. The depressions corresponding to the sulculo-lateral mesenteries are most evident; those of the sulcar pair are less distinct, but those of the sulcular pair are not indicated. In a slightly later stage the sulcular mesenteries have made their appearance, the sulco-lateral are relatively very large, and their terminal filaments are very conspicuous. The other six mesenteries are quite small, and appear to be uniform in size. In the upper portion of the body all eight mesenteries reach the œsophagus, and the rudiments of their longitudinal muscles are visible. These have the arrangement characteristic of Edwardsia.

In the brief abstract just given of Prof. de Lacaze Duthiers' researches, his account has been given without comment, and his numeration of the mesenteries and lettering of the mesenteric chambers has been adhered to. According to the system of nomenclature which I now propose, the development of the mesenteries is as follows:—1. Sulcular sulco-laterals; 2. sulcular directives; 3. sulcar directives; 4. sulcular sulculo-laterals; 5. sulcar sulculo-laterals; 6. sulcar sulco-laterals. The chambers being *a*, sulcar endocœle; *a'* sulcular endocœle; *b*, sulcular exocœle; *c*, sulcar exocœle; *d*, sulculo-lateral endocœle; *e*, lateral exocœle; *f*, sulco-lateral endocœle.

When these researches were published attention had not been called to the importance of the position of the longitudinal retractor muscle of the mesenteries in the morphology of the Actiniæ, and Prof. de Lacaze Duthiers makes no mention of this structure. The identity of the general disposition of the mesenteries and their relative size had led me to regard the fourth stage of the above account as being in every way comparable with the larva of *Halcampa chrysanthellum* which I have previously described (1887). At my suggestion, my pupil, Mr. Francis Dixon, has commenced an investigation upon the embryology of Actiniæ, and he has kindly permitted me to anticipate some of the results he has arrived at. Mr. Dixon has cut transverse sections of larvæ of Prof. de Lacaze Duthiers' three types, viz. *Actinia equina*, *Cereus pedunculatus*, and *Bunodes verrucosa*, with the anticipated result. In these representative species of three different families of Actiniæ, the development of the mesenteries is similar in all, both as regards the order of their appearance and the disposition of their muscles, and they are also identical with those of the larva of Halcampa (I am now confining myself to the first six pairs of mesenteries, which probably, alone, are of primary importance).

The only definite observation which is opposed to this statement is that of the Brothers Hertwig (1879). Their account of the disposition of the mesenteries in

Adamsia diaphana has already been given. In order to bring Prof. de Lacaze Duthiers' description into harmony with their observation, they assume that the French zoologist has mistaken the order of appearance of his second and fourth pairs of mesenteries. By interchanging these two numbers, and by supposing that the longitudinal muscles of the first and second (according to them) mesenteries face one another, they bring the older account into accord with the eight perfect mesenteries of their first stage. With all due deference to the distinguished German zoologists, it seems to be somewhat unfair to throw doubt upon the very careful and minute investigations of Prof. de Lacaze Duthiers, and it affords me great pleasure to be able to corroborate and extend the observations of the illustrious French savant. *Adamsia diaphana* is a Sagartian, as is also *Cereus pedunculatus*, and it requires to be studied anew, especially its earlier stages.

GENERAL CONSIDERATIONS.

The following deductions, based upon embryological and anatomical evidence, appear to be warranted by the present state of our knowledge :—

1. In larval Actiniæ two mesenteries arise at right angles to the long axis of the œsophagus, and divide the archenteron (cœlenteron) into two chambers.

These two chambers are unequal in *Actinia equina*, *Cereus pedunculatus*, *Cylista undata*, *Bunodes verrucosa*, and *Edwardsia lineata*, (?) and possibly also in *Cerianthus membranaceus*, and in *Actinia* sp. (Kowalevsky).

2. A pair of mesenteries appears in the larger of the two primitive chambers of the cœlenteron. Apparently this stage is common to all investigated Actiniæ; but as no observations have been made on the mesenteries of Cerianthus beyond the first stage, it must be left out of consideration.

3. A third pair of mesenteries develops in the smaller of the two primitive chambers. Immediately afterwards another pair of mesenteries appears.

In the first four species the fourth pair of mesenteries arises between the first and second, that is, in the lateral chambers of the larger of the primitive divisions of the cœlenteron; but in *Edwardsia lineata* (?) the new pair appears within the single or terminal chamber of the same division. Prof. Kowalevsky's account of the development of the seventh and eighth mesenteries cannot be brought into harmony with the preceding.

A short resting stage now occurs in which eight mesenteries are alone present, and the corresponding chambers of the cœlenteron are produced into eight tentacles.

This appears to be a characteristic phase in the development of all the Actiniæ hitherto studied, with the exception of Cerianthus. There is now evidence to support the conclusion that in most, and probably in all other larval Actiniæ, these eight mesenteries are homologous with those of the Edwardsiæ. In other words, such forms as Halcampa, Actinia, Cereus, Bunodes, and probably many, if not all other sea-anemones (except Cerianthus), pass through a larval stage, which is permanently retained in the adult Edwardsiæ.

4. The next stage is characterized by the practically simultaneous development of two pairs of mesenteries: these for some time remain imperfect: their longitudinal muscles face those of the first and fourth mesenteries respectively.

This condition exists in *Gonactinia prolifera*, and practically permanently in the Zoantheæ, although in the Epizoanthus group the equivalent of the sixth pair of mesenteries reach the œsophagus. The terminal zone of mesenteric development is a special feature added on to the above arrangement. This fourth stage occurs for a long time in the larva of Halcampa, but it is more rapidly passed over in the four species described by Prof. de Lacaze Duthiers.

5. The fifth and sixth pairs of mesenteries now reach the œsophagus, and constitute the ground or fundamental form of the typical hexamerous Actiniæ. Twelve tentacles also appear, which usually range themselves in two series, those belonging to the six endocœles being usually more prominent than the others.

The adults of Halcampa, Peachia, the Sagartidæ, and the groups which receive *Actinia equina* and *Bunodes verrucosa*, pass through this stage. The Halcampa, described by Prof. R. Hertwig as *H. clavus* (1882), does not advance further.

6. A pair of small mesenteries, with their longitudinal muscles facing one another, is developed in each exocœle.

This is the permanent condition of *Halcampa chrysanthellum* and *H. arenarea*, except that the longitudinal muscles are undeveloped. In the adult of *Peachia hastata* strong longitudinal muscles are developed on the new small mesenteries, but only four pairs of mesenteries are formed. Those corresponding to the sulcular exocœl (chamber *b* of diagram, Pl. XXXVII., fig. 12) are absent. The other hexamerous Actiniæ mentioned above pass beyond this stage.

7. These mesenteries grow larger, and other pairs appear successively in every exocœle until a considerable number is formed.

Amongst the family Sagartidæ the members of the sub-family Chondractininæ are characterized by the six primary pairs of mesenteries alone reaching the œsophagus, the six pairs of the second cycle, those referred to in the preceding paragraph (6), are imperfect, although mesenteries of the third, fourth, and even of the fifth cycle may be present. In the sub-family Sargartinæ, however, the mesenteries of the second cycle and those of other cycles may, in a more or less irregular manner, reach the œsophagus. In other Actiniæ all the mesenteries may be perfect.

As has been pointed out by other authors, we have the remarkable fact that in the early development of the Actiniæ the six-rayed arrangement of parts does not occur, typical as it is of the adults, although it is not so universal as is popularly imagined. As the late Prof. F. M. Balfour pointed out (**1880**, p. 140) the number of mesenteric chambers increases in arithmetical progression up to a certain stage; thus we have for both mesenteries and their chambers the numbers 2, 4, 6, 8, 10, 12, but of these the numbers 2, 4, 8, 12, are of chief importance, and alone appear to possess any phylogenetic significance.

I am not aware of any adult Hydroid-like organism which possesses a pair of mesenterial ridges and two tentacles.

The relationship of the Hydra-tuba and Scyphostoma stages of the Scyphomedusæ (Acalephæ) to the Zoantharia is now generally admitted, indeed a group (Tæniolatae) has been erected by Professor E. Hæckel to include them both. Later Professor A. Göette (**1887**) has similarly proposed the term Scyphozoa for the same assemblage, but including the Ctenophora, as opposed to the remaining Cœlenterata or Hydrozoa. The Scyphostoma have an œsophagus lined by ectoderm (Stomodæum), four glandular mesenteries, the edges of which are true craspeda, and serve to digest food; in their upper portion nematocysts are present. The four tentacles are afterwards increased to eight, and finally to sixteen. It is especially noteworthy that at first there are only two tentacles: probably this is a reminiscence of a remote ancestor. The widespread occurrence of a symmetry of four amongst the larvæ of the Scyphozoa is very suggestive.

One is tempted to recall the tetrameral symmetry of the Rugose Corals (Tetracoralla), as indicative of relationship to some primitive Scyphozoon, but for the warning of Mr. J. J. Quelch (**1886**, p. 42), who says:—“Thus, as the result of the foregoing considerations, there is not a single characteristic of the old group Rugosa which will essentially separate its forms from the more typical Astræids; and a direct expression is given to this fact by placing the families of the old Rugosa (except the family Cyathaxonidæ, which has been placed under the subsection Turbinolida) with the family Astræidæ, under the sub-section Astræida.”

A permanent octoradiate condition occurs in Edwardsia; but it is difficult to see where the Octocoralla (Alcyonaria) fit in; most probably they diverged much earlier from the Scyphozoon stock.

The passage from an eight-rayed to a twelve-rayed symmetry has already been fully described.

The following table illustrates the foregoing conclusions. It is designed to illustrate various stages of development of certain Actiniæ, but not to assert a phylogeny.

The time has not yet arrived when we can construct a classification of the Actiniæ as a whole.

Stages of development in terms of mesenteries.	Table of lines of development of certain Actiniæ.					
12 + 12 24, &c.					Typical hexameral Actiniæ	
12 + 12			Peachia	Halcampa	(*young*)	
12				Halcampa	(*young*)	
8 + 4			Gonactinia	(*young*)	(*young*)	—Zoantheæ.
8		Edwardsia	(*young*)	(*young*)	(*young*)	
4	Scyphostoma larva,	(*young*)	(*young*)	(*young*)	(*young*)	
2	(*young*)	(*young*)	(*young*)	(*young*)	(*young*)	—Ceriantheæ ?

Above the black line new mesenteries arise in pairs within each exocœle, or radially.

Below the line the mesenteries appear bilaterally with respect to the long axis of the œsophagus.

The order of development of the mesenteries, later than those of their respective fundamental forms in both the Ceriantheæ and the Zoantheæ is also bilateral.

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Part	pp.	Date	Part	pp.	Date
Part i.,	pp. 1–32,	March, 1858.	Part viii.,	pp. 225–256,	May, 1859.
„ ii.,	pp. 33–64,	May, „	„ ix.,	pp. 257–288,	July, „
„ iii.,	pp. 65–96,	July, „	„ x.,	pp. 289–320,	Sept., „
„ iv.,	pp. 97–128,	Sept., „	„ xi.,	pp. 321–352,	Nov., „
„ v.,	pp. 129–160,	Nov., „	Preface,		Dec., „
„ vi.,	pp. 161–192,	Jan., 1859.	Part xii.,	pp. 353–362,	Jan., 1860.
„ vii.,	pp. 193–224,	March, „			

I have deemed it advisable to give the dates of publication of these parts, as it will clear up some otherwise inexplicable facts of contemporary literature; for example, species apparently described by Mr. Gosse in 1860 are alluded to by authors in 1858. I gather from Mr. Gosse that only the first four parts were dated. As the date was only on the temporary cover, and not in the letterpress, all the species described in this work must date from 1860, the date on the title-page of the book when complete.]

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EXPLANATION OF PLATE XXXI.

PLATE XXXI.

Chitonactis marioni, n. sp.

Figure.

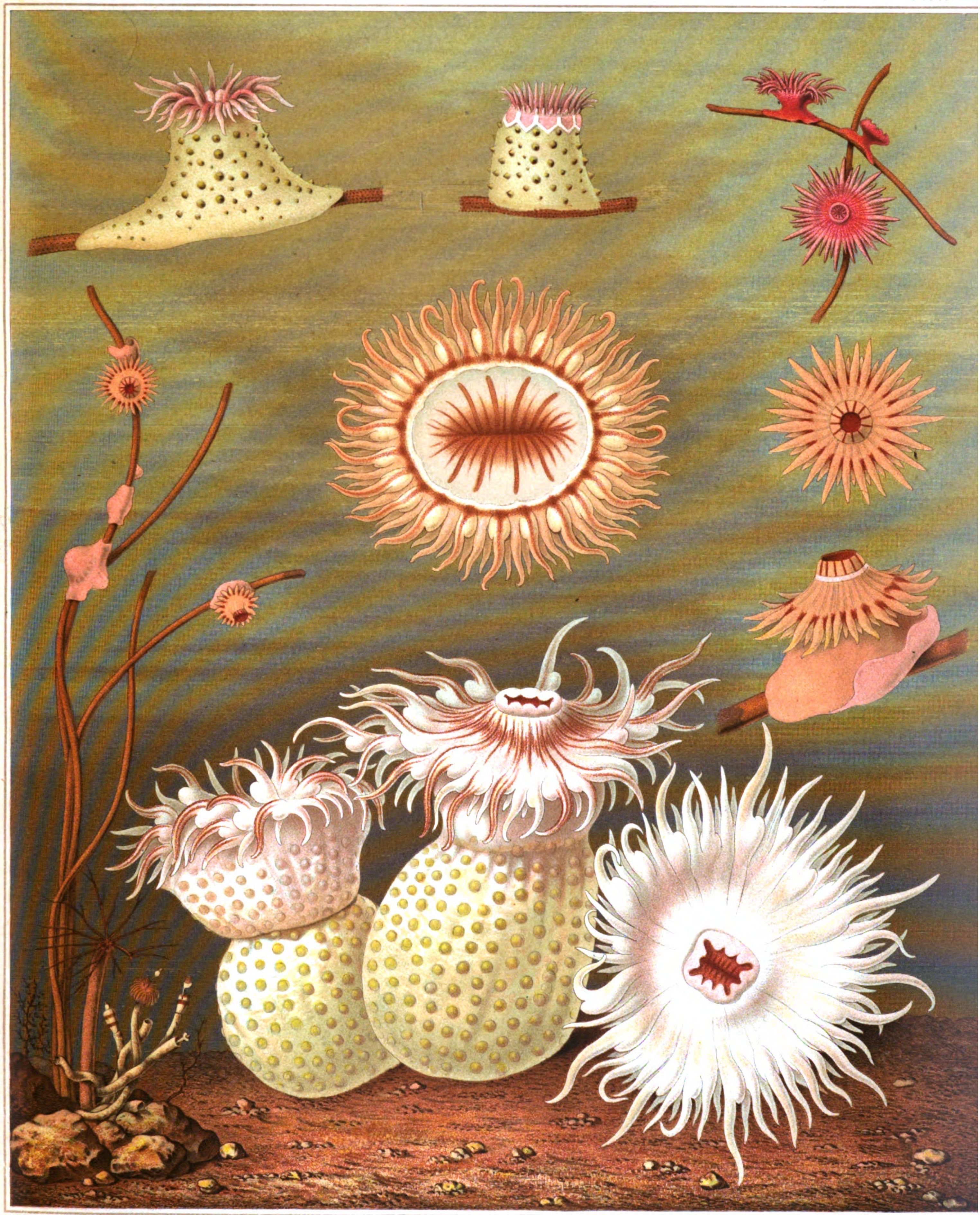
1. Side view of fully expanded animal on a spine of *Dorocidaris papillata*.
2. Side view of upper portion of the same during retraction.

Gephyra dohrnii, von Koch.

3. Group of cherry-coloured variety from locality near Great Skellig.
4. Groups of several specimens on tubes of *Tubularia indivisa*.
5. Side view of one of the same, and disc.

Actinauge richardi (Marion).

6. Group of three individuals, fully expanded; above, disc of another specimen with everted œsophagus; natural size.



A.C.H.a.T.H.T del.

Lith. Anst. v. Werner & Winter, Frankfurt.

EXPLANATION OF PLATE XXXIV.

PLATE XXXIV.

LETTERING ADOPTED IN ALL THE FIGURES.

a.,	acontia.	*m. f.*,	mesenterial filament.	*s. d.*,	sulcar directive mesentery.
ax. t.,	axial tentacle.	*n.*,	nucleus.	*s. l. en.*,	sulco-lateral endocœle.
c. m.,	circular muscle.	*œs.*,	œsophagus.	*sl.*,	sulculus.
c. m. en.,	circular muscles of endoderm.	*œs. gr.*,	œsophageal groove.	*sl. d.*,	sulcular directive mesentery.
		ov.,	ovum.		
cu.,	cuticle.	*p. d.*,	pedal disk.	*sl. en.*,	sulcular endocœle.
d.,	directive mesenteries.	*p. m.*,	parietal muscle.	*sl. ex.*,	sulcular exocœle.
ec.,	ectoderm.	*r. m.*,	retractor muscle.	*sl. l. en.*,	sulculo-lateral endocœle.
en.,	endoderm.	*sc.*,	sucker.	*s. l. m.*,	sulco-lateral mesentery.
g. s.,	grains of sand.	*s.*,	sulcus.	*sl. l. m.*,	sulculo-lateral mesentery.
l. ex.,	lateral exocœle.	*s. en.*,	sulcar endocœle.	*sp.*,	sperm-cell.
m.,	mesoglœa.	*s. ex.*,	sulcar exocœle.	*z.*,	zooxanthellæ.

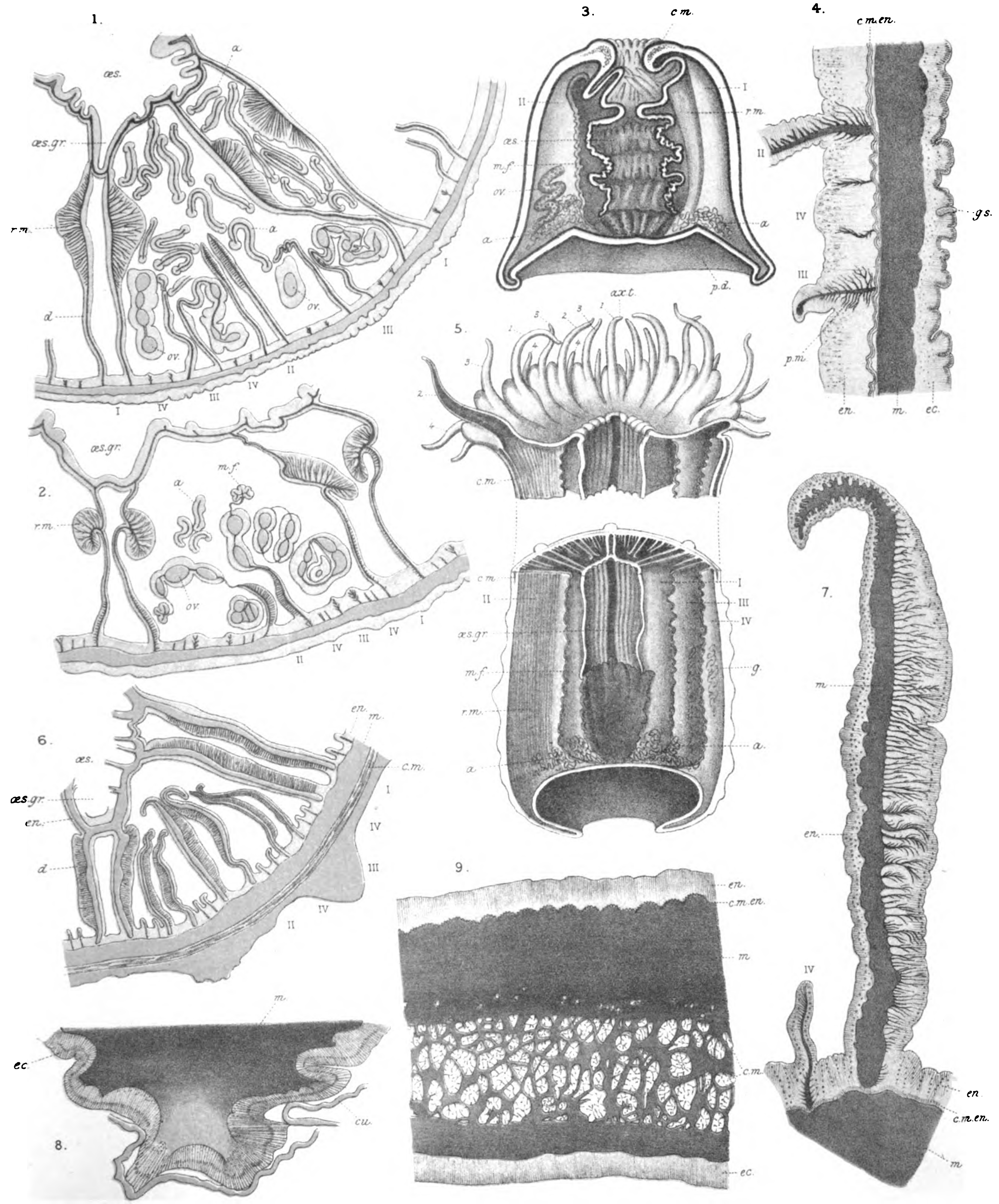
Paraphellia expansa, Haddon.

Figure.

1. Transverse section through middle of œsophageal region, $\frac{3}{a * 10}$.
2. Transverse section through inferior portion of œsophageal region, $\frac{3}{a * 1}$.
3. Vertical section of entire animal, × 4.
4. Transverse section of a portion of the body-wall, $\frac{2}{B}$.

Actinauge richardi (Marion).

5. Diagrammatic vertical section; natural size.
6. Transverse section through œsophageal region, $\frac{3}{a * 5}$.
7. Transverse section of secondary mesentery, $\frac{2}{A}$.
8. Section of a tubercle, $\frac{3}{B}$.
9. Longitudinal section of a portion of the sphincter muscle.



A C Haddon del. ad nat.

F. Huth, Lith^r Edin^r

EXPLANATION OF PLATE XXXVI.

PLATE XXXVI.

LETTERING ADOPTED IN ALL THE FIGURES.

a.,	acontia.	*m. f.*,	mesenterial filament.	*s. d.*,	sulcar directive mesentery.
ax. t.,	axial tentacle.	*n.*,	nucleus.	*s. l. en.*,	sulco-lateral endocœle.
c. m.,	circular muscle.	*œs.*,	œsophagus.	*sl.*,	sulculus.
c. m. en.,	circular muscles of endoderm.	*œs. gr.*,	œsophageal groove.	*sl. d.*,	sulcular directive mesentery.
		ov.,	ovum.		
cu.,	cuticle.	*p. d.*,	pedal disk.	*sl. en.*,	sulcular endocœle.
d.,	directive mesenteries.	*p. m.*,	parietal muscle.	*sl. ex.*,	sulcular exocœle.
ec.,	ectoderm.	*r. m.*,	retractor muscle.	*sl. l. en.*,	sulculo-lateral endocœle.
en.,	endoderm.	*sc.*,	sucker.	*s. l. m.*,	sulco-lateral mesentery.
g. s.,	grains of sand.	*s.*,	sulcus.	*sl. l. m.*,	sulculo-lateral mesentery.
l. ex.,	lateral exocœle.	*s. en.*,	sulcar endocœle.	*sp.*,	sperm-cell.
m.,	mesoglœa.	*s. ex.*,	sulcar exocœle.	*z.*,	zooxanthellæ.

Edwardsia tecta, n. sp.

Figure.

1. Transverse section through the œsophageal region, $\frac{2}{A}$.
2. Transverse section through a mesentery, $\frac{2}{C}$.

Edwardsia timida, Quatrefages.

3. Transverse section through a mesentery, $\frac{2}{A}$.

Edwardsia beautempsii, Quatrefages.

4. Transverse section through a mesentery, $\frac{2}{C}$.

Edwardsia carnea, Gosse.

5. Transverse section through the parietal muscle of a mesentery, $\frac{3}{C}$.
6. Transverse section through a longitudinal retractor muscle, $\frac{3}{C}$.

Halcampa chrysanthellum (Peach).

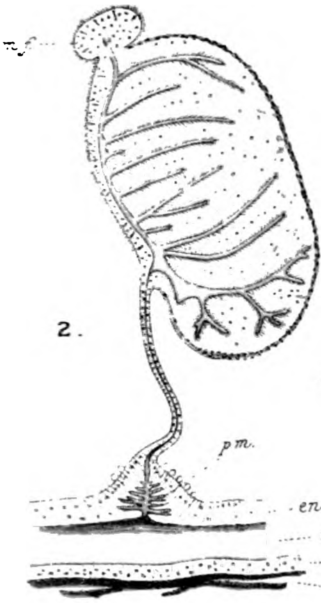
7. Transverse section through a fertile (male) mesentery, $\frac{2}{A}$.

Halcampa arenarea, Haddon.

8. Transverse section through the œsophagus, $\frac{2}{B}$.
9. Transverse section through a fertile (female) mesentery, $\frac{2}{B}$.
10. Section through an ovum, showing the formation of a polar-body while still within the mesentery, $\frac{2}{C}$.

Plate XXXVI.

2.



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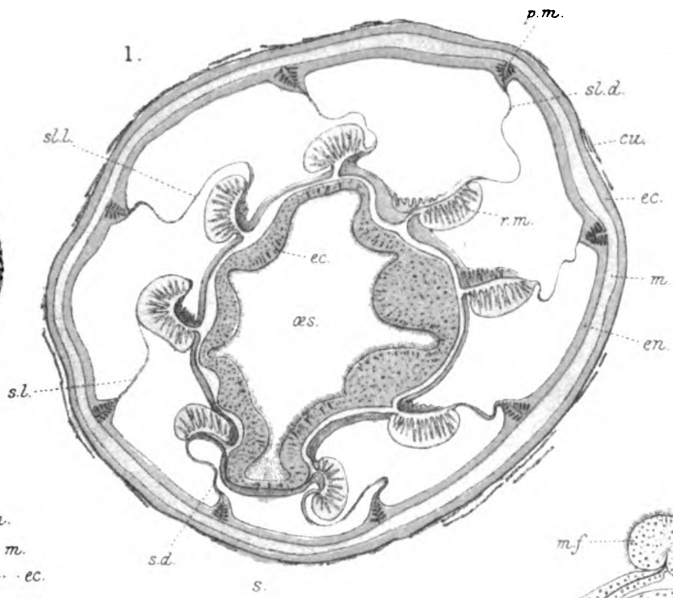

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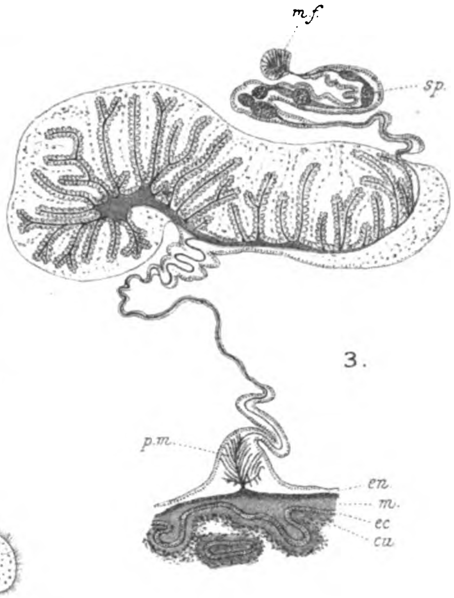

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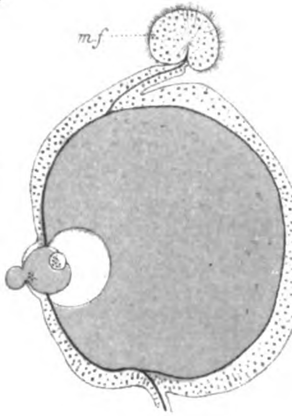

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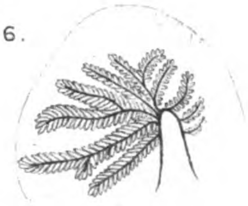

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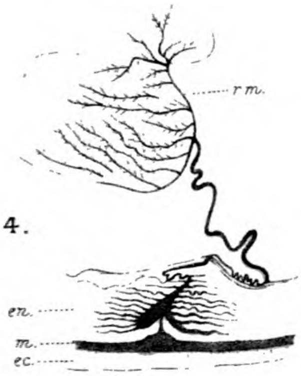

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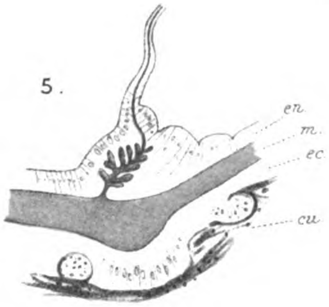

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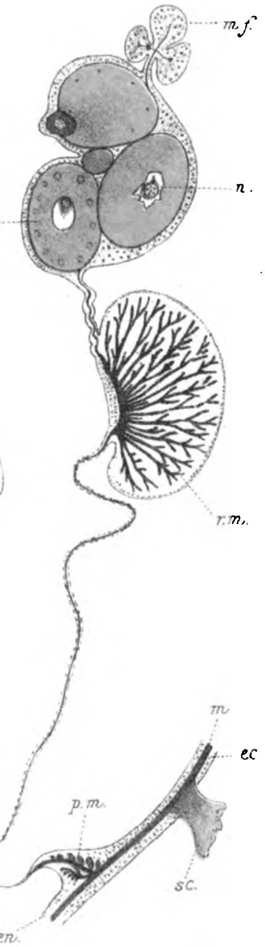

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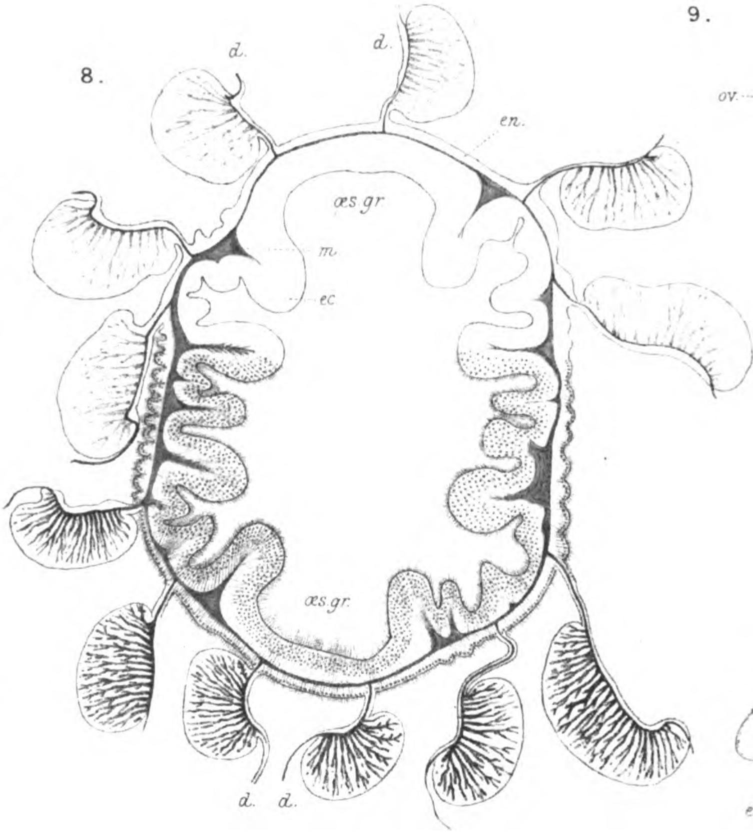

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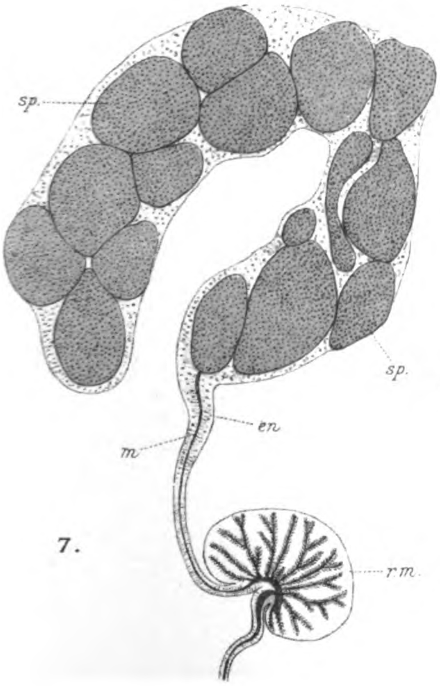


A.C. Haddon del. ad nat

F. Huth, Lith^r Edin^r

EXPLANATION OF PLATE XXXVII.

PLATE XXXVII.

LETTERING ADOPTED IN ALL THE FIGURES.

a., . . .	acontia.
ax. t., . .	axial tentacle.
c. m., . .	circular muscle.
c. m. en., .	circular muscles of endoderm.
cu., . . .	cuticle.
d., . . .	directive mesenteries.
ec., . . .	ectoderm.
en., . . .	endoderm.
g. s., . .	grains of sand.
l. ex., . .	lateral exocœle.
m., . . .	mesoglœa.
m. f., . .	mesenterial filament.
n., . . .	nucleus.
œs., . . .	œsophagus.
œs. gr., .	œsophageal groove.
ov., . . .	ovum.
p. d., . .	pedal disk.
p. m., . .	parietal muscle.
r. m., . .	retractor muscle.
so., . . .	sucker.
s., . . .	sulcus.
s. en., . .	sulcar endocœle.
s. ex., . .	sulcar exocœle.
s. d., . .	sulcar directive mesentery.
s. l. en., .	sulco-lateral endocœle.
sl., . . .	sulculus.
sl. d., . .	sulcular directive mesentery.
sl. en., . .	sulcular endocœle.
sl. ex., . .	sulcular exocœle.
sl. l. en., .	sulculo-lateral endocœle.
s. l. m., .	sulco-lateral mesentery.
sl. l. m., .	sulculo-lateral mesentery.
sp., . . .	sperm-cell.
z., . . .	zooxanthellæ.

Figure.

1. Diagrammatic section through the œsophageal region of Zoanthus.

2. Diagrammatic section through the œsophageal region of Epizoanthus.

3. Diagrammatic section through the œsophageal region of a young Zoanthus, slightly modified from R. Hertwig (*i. e.* the retractor muscles of the mesenteries are added).

4. Diagram of a larval Zoanthus ("Microgrundform").

5. Diagram of a larval Epizoanthus ("Macrogrundform").

7. Larva of *Halcampa chrysanthellum.* *A*, diagrammatic transverse section through œsophageal region; *B*, similar section through digestive region.

8. Larva of *Actinia equina* (after Lacaze Duthiers), first appearance of mesenteries. *a*, Smaller chamber (sulcar endocœle); *a'*, larger chamber (sulcular endocœle); 1, first pair of mesenteries.

9. Larva of *Actinia equina* (after Lacaze Duthiers). Stage of four mesenteries. (Lettering as before) *b*, first lateral chamber (sulcular exocœle); 2, second pair of mesenteries.

10. Larva of *Actinia equina* (after Lacaze Duthiers). (Lettering as before) *c*, second lateral chamber (sulcar exocœle); *d*, third lateral chamber (sulculo-lateral endocœle); 3 and 4, third and fourth pairs of mesenteries.

11. Larva of *Actinia equina* (after Lacaze Duthiers). Octoradiate stage. (Lettering as before.)

12. Larva of *Actinia equina* (after Lacaze Duthiers). Later stage than fig. 11. (Lettering as before) *e*, fourth lateral chamber (lateral exocœle); *f*, fifth lateral chamber sulco-lateral endocœle); 5 and 6, fifth and sixth pairs of mesenteries.

13. Larva of *Actinia equina* (after Lacaze Duthiers). Optical section of same stage as last. (Lettering as before.) The mesenterial filaments have a size proportional to the order of their development.

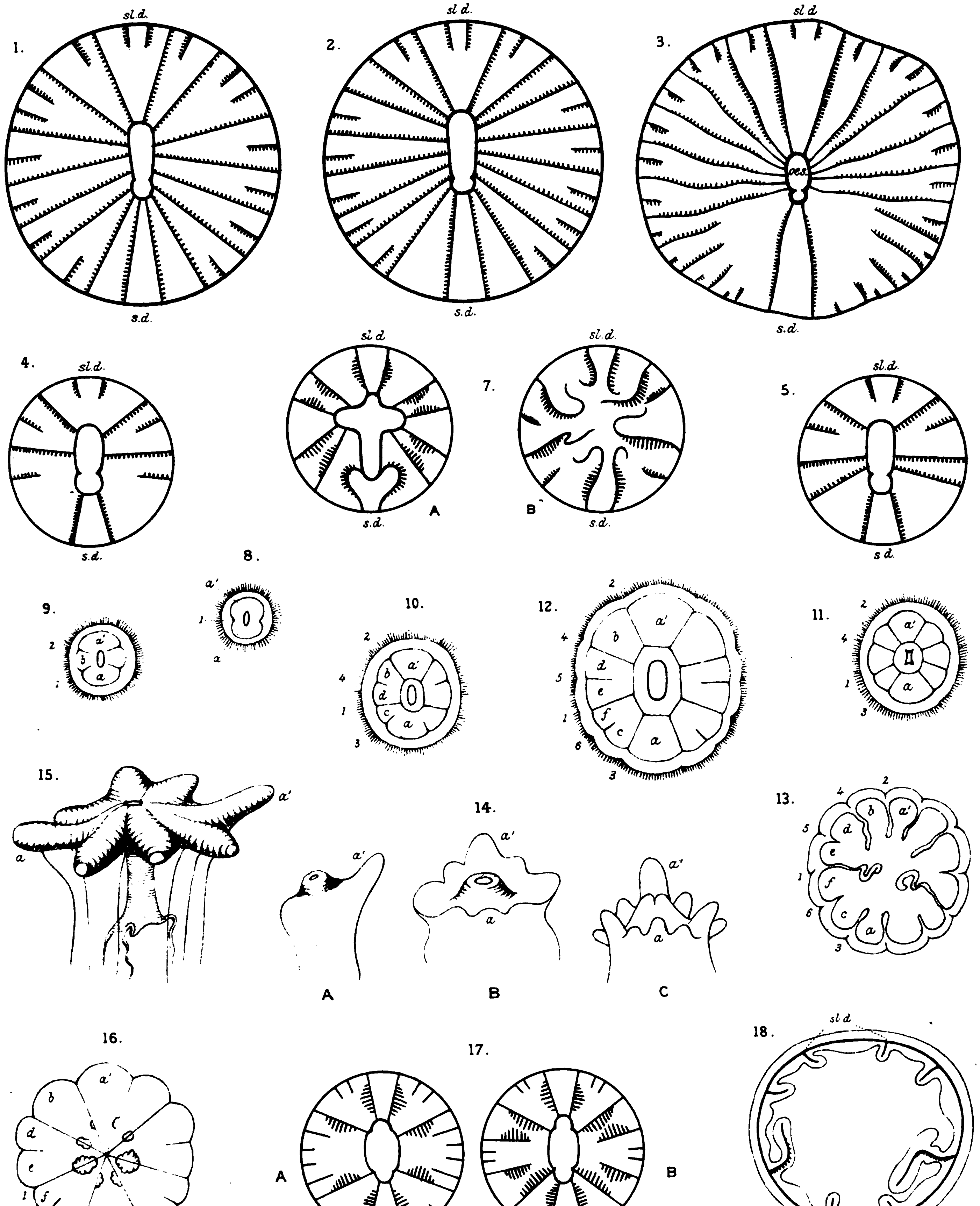
14. Larva of *Actinia equina* (after Lacaze Duthiers). Three stages in the development of the tentacles—*A*, stage with only one tentacle; *B*, octoradiate stage; *C*, stage with twelve tentacles; *a*, sulcar; *a'*, sulcular extremities of axial line.

15. Larva of *Bunodes verrucosa* (after Lacaze Duthiers). Oral end of octoradiate stage. *a*, sulcar tentacle; *a'*, sulcular tentacle.

16. Larva of *Bunodes verrucosa* (after Lacaze Duthiers). Optical section of an early stage, with twelve chambers—*a*, sulcar endocœle; *a'*, sulcular endocœle; *b*, sulcular exocœle; *c*, sulcar exocœle; *d*, sulculo-lateral endocœle; *e*, lateral exocœle; *f*, sulco-lateral endocœle; 1, first pair of mesenteries developed with craspeda.

17. *Adamsia diaphana* (after O. and R. Hertwig). *A*, diagrammatic transverse section through the œsophageal region of a young form; *B*, similar section, through an older individual.

18. Diagrammatic transverse section through the digestive region of a larval *Cereus pedunculatus.*



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[November, 1891.]

THE
SCIENTIFIC TRANSACTIONS
OF THE
ROYAL DUBLIN SOCIETY.

VOLUME IV. (SERIES II.)

XII.

A REVISION OF THE BRITISH ACTINIÆ. PART II.: THE ZOANTHEÆ.

By ALFRED C. HADDON, M.A. (Cantab.), M.R.I.A., Professor of Zoology, Royal College of Science, Dublin; and MISS ALICE M. SHACKLETON, B.A. Plates LVIII., LIX., LX.

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[Read February 18, 1891.]

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INTRODUCTION.

The first part of this Revision dealt with a new sub-family of the Sagartidæ, the Chondractininæ, which included the genera Chondractinia, Hormathia, Chitonactis, Actinauge, and Paraphellia. A few notes were made on the genus Sagartia; and details are given of British representatives of *Gephyra dohrnii.* The British members of the families Edwardsidæ and Halcampidæ were described; and the nature of *Gonactinia prolifera* was discussed. An account was also given of the arrangement of the mesenteries in the Zoantheæ. The Paper concluded with a summary of the development of the mesenteries of Actinia; and certain general considerations were advanced on the phylogenetic value of the mesenteries. Unavoidable circumstances caused this first part of the Revision to be heterogeneous in character, and unsatisfactory in many details.

The present instalment of the Revision is confined to a very distinct group of the Actiniæ. Although there has been considerable confusion within the group, the

Zoantheæ themselves have, since the time of de Blainville, been recognized as a well-marked division of the Actiniæ.

With the exception of the genus Sphenopus, and certain free varieties of the genus Epizoanthus, all the members of this group are permanently fixed, and with very few exceptions form colonies, the individuals of which are united by the adhering base or cœnenchyme. The cœnenchyme extends laterally, and from it new polyps arise, which remain permanently connected with the colony.

The cœnenchyme may be band-like or form broad encrusting sheets; usually it is thin, but in the genus Palythoa it is so thick that the polyps are more or less immersed within it. The polyps may be placed at considerable intervals from each other, or they may be crowded together, the latter condition being usually due to gemmation from the base of the polyps rather than from the cœnenchyme.

It is characteristic of the group for the body-wall of the polyp and cœnenchyme to be incrusted with foreign particles—grains of sand, spicules, foraminifera, and such like. Some genera, such as Palythoa and Sphenopus, are always densely incrusted; the incrustations in Parazoanthus vary according to the species from a considerable amount to very few; finally, the genera Zoanthus and Mammillifera are unincrusted.

The Zoantheæ have the same body-regions as other Actiniæ, with the exception of the basal disc, which must necessarily be absent in the colonial forms, and of a physa in the free forms. In all the column is divisible into scapus and capitulum; the former is usually rigid. In nearly all preserved specimens the capitulum is retracted, and this appears to be generally the case when living, for these forms do not fully expand so frequently as most other sea-anemones. The capitulum is usually thrown into triangular ridges.

The tentacles are bicyclic, and may be very short or moderately long. When fully expanded, the oral disc may be flat or projecting. The mouth is always linear. Only one œsophageal groove is present.

The colours are usually various shades of yellow, buff, and brown, due to the sand incrustations; some have varied colours—pink, green, violet, and so forth—but it is very rare for the colours to be so vivid as is customary among other Actiniæ.

Reproduction takes place by means of ova, by basal and cœnenchymatous gemmation, and by fission.

The foregoing are all the characters which are available for the field naturalist, and, until quite recently, were the only ones on which the definition of species and their systematic arrangement were based. These purely external characters are more than usually unsatisfactory for diagnostic purposes; hence the not unnatural confusion into which the group has fallen, and from which it has, to a certain extent, been extricated through the labours of Erdmann and McMurrich. In no group is it more necessary to combine anatomical and microscopical examination with the methods of the older zoologists—for the species of Zoantheæ can only be established after sections have been cut and studied. The identification of new material with recognized species requires the utmost circumspection.

It is impossible to determine the genus to which many previously described species belong until the types have been re-discovered, and then submitted to an anatomical investigation. A complete monograph of the group is at present an impossibility. We have, however, ventured as far as we safely could in this direction.

We have investigated the anatomy of eleven species belonging to five genera of Zoantheæ from Torres Straits, besides several other forms, at the same time that we were occupied upon the British representatives. Our Paper on the Torres Straits specimens is published simultaneously with this one, and in the same Journal; and we would ask those who are interested in this group to study both Papers together, for the two are, to a certain extent, complementary to each other.

Methods.—All the specimens examined by us were preserved in alcohol, and when a sufficient quantity of strong alcohol is used this answers perfectly well. We stained the objects whole in borax carmine, imbedded them in paraffin, and cut them with a "rocking" microtome. In a few cases we stained the sections after they were fixed on the slides.

The unincrusted genera are very easy to cut, and so are some of the incrusted forms, especially some of the species of Parazoanthus. Those wishing to study the anatomy of the group cannot do better than commence with *P. axinellæ*, which is very easily cut by the ordinary paraffin method. It was perfectly unnecessary for von Koch to employ his "Schliff-methode" (Morph. Jahrb. vi., 1880, p. 359) when investigating this species. We mention this solely to prevent others from taking superfluous trouble. The different species of the genus Epizoanthus are, as a rule, difficult to sectionize, on account of the incrustations. *E. paguriphilus* is, however, practically free from them; owing to the great thickness of the mesoglœa in this species, celloidin is a better imbedding material than paraffin, as heat has to be employed in the latter method. As a rule, the incrustations in Zoantheæ from coral seas are calcareous, and admit of being readily dissolved away. We use nitric acid for this purpose.

The use which we have made of the Papers of Erdmann and McMurrich will emphasize the indebtedness of students of the Zoantheæ to those investigators. References to other workers will be duly acknowledged where we utilize their results. The laborious monograph of Andres has been in constant requisition.

It is now our pleasing duty to acknowledge the assistance of many friends. The Rev. Canon. A. M. Norman and Professor W. C. M'Intosh have generously placed the whole of their collections at our service; and it is due to the considerable number of foreign (Mediterranean and North Atlantic) specimens belonging to the former that we have been enabled to determine several non-British species. The Director of the Marine Biological Laboratory at Plymouth, and Mr. G. Y. Dixon have also supplied us with specimens, as have also our foreign colleagues, Drs. D. C. Danielssen and J. Playfair M^cMurrich. Finally, we have to thank Dr. E. Perceval Wright for the loan of books and for ready assistance in the solution of taxonomic and synonymic difficulties.

GENERAL ACCOUNT OF THE ANATOMY OF THE ZOANTHEÆ.

The main external characters of the Zoantheæ have already been given in the Introduction; and before giving a detailed account of the anatomy of the group it will be necessary to say a few words as to the anatomy of these Actiniæ.

As in other Actinozoa, the body-wall is composed of three layers: the ectoderm, the mesoglœa, and the endoderm. There is now no need to adduce arguments in favour of the employment of the second of these terms.

The mouth leads into a rather short œsophagus or stomatodæum, the walls of which are often thrown into folds; at one end a distinct and sometimes a very deep groove is present, for which one of us has suggested the name of "sulcus," or sulcar groove. Projecting into the cavity, or cœlenteron of the polyp, from its body-wall, are a number of soft plates which are known as mesenteries; sometimes these are called "sarcosepta," and occasionally they are erroneously spoken of as "septa." The employment of the latter term cannot be too strongly deprecated as leading to confusion with the septa, or calcareous radial partitions of the Madreporaria.

The mesenteries of the Zoantheæ fall under two categories—

(1) The large mesenteries which extend from the body-wall to the stomatodæum, and which alone bear mesenterial filaments and gonads. These are the "perfect mesenteries" or "macrosepta" of authors.

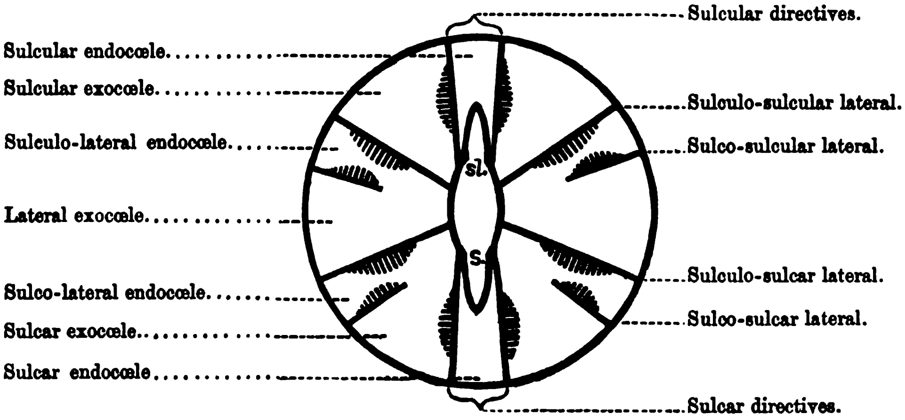
(2) The small mesenteries which extend only slightly from the body-wall into the cœlenteron, and which are sterile, and do not bear mesenterial filaments. These are the "imperfect mesenteries" or "microsepta."

As in most Actiniæ a pair of mesenteries occurs at each end of the œsophagus; these are usually spoken of as the "directives," or "directive mesenteries."

The mesenteries which yield such a valuable aid to classification in the Actiniæ generally are arranged in this group in a very uniform manner.

In the first part of this revision (**1889**, p. 343), a short account is given of the history of the elucidation of the arrangement of the mesenteries in the Zoantheæ. Since this was written the second part of Hertwig's "Challenger" Report has been published, without, however, adding anything to Erdmann's account. McMurrich has also written two valuable Papers (**1889** and **1889 A**), but no new type of mesenteric arrangement has been described beyond those first pointed out by Hertwig (**1882**), and properly described by Erdmann.

It is necessary to have a recognized system of terminology in order to describe the arrangement of the mesenteries in the Actiniæ; and it is advisable to have such a terminology as is applicable to the whole of the Actinozoa. One of us has already (**1889**) proposed the adoption of certain terms, and the abolition of others which have not a precise meaning—as, for example, such words as "dorsal" and "ventral," these latter were replaced by "sulcular" and "sulcar," respectively. When only one axial œsophageal groove is present, it is usually (? always) the sulcar. In the same Paper attention was called to the value of the order of the appearance of the mesenteries in young Actiniæ, as suggesting the affinities of different groups of sea-anemones. The following diagram illustrates the proposed method of naming the mesenteries and chambers at a stage when twelve mesenteries have made their appearance:—



Examples.—Edwardsia has a pair of sulcular and a pair of sulcar directives; a sulculo-sulcular lateral mesentery, and a sulculo-sulcar lateral mesentery on each side, all of which are perfect.

The larval form of Zoanthus has a pair of sulcular imperfect directives and a pair of sulcar perfect directives; a sulculo-sulcular lateral perfect mesentery, a sulco-sulcular lateral imperfect mesentery, a sulculo-sulcar lateral perfect mesentery, and a sulco-sulcar lateral imperfect mesentery on each side.

The larval form of Epizoanthus agrees with Zoanthus, except that the sulco-sulcar lateral mesenteries are perfect.

In the Zoantheæ new mesenteries appear in the sulcar exocœles in such a way that the mesenteries nearest the sulcus are the youngest, and those furthest from it the eldest.

In the Sagartidæ the new mesenteries appear in pairs in all the exocœles.

The mesenterial filaments, the gonads, the mesenteric canals, and the cœnenchyme will be dealt with later on. We will now proceed to describe the structure of the Zoantheæ in greater detail in the following order:—

Body-wall—ectoderm, incrustations; mesoglœa, cell-enclosures, endodermal bays, ectodermal bays; endoderm, diffuse endodermal muscle, sphincter muscle; capitulum.

Tentacles and Disc.

Œsophagus.

Mesenteries.—Imperfect mesenteries, perfect mesenteries, reflected ectoderm and mesenterial filaments, mesoglœa, canals, endoderm, muscles, gonads.

Cœnenchyme.

Development.

Parasites.

Body-wall.—*Ectoderm.*—The ectoderm is very liable to be rubbed off in the incrusted genera; where present it generally appears as a continuous layer of narrow columnar cells. In the unincrusted genera, in *Gemmaria macmurrichi* and in *Epizoanthus paguriphilus*, the ectoderm is traversed by strands of mesoglœa, which unite to form a layer peripheral to the ectoderm, and which, in some species break up the ectoderm into more or less cubical blocks (Pl. LIX., fig. 6).

External to the ectoderm there is always a cuticular layer which may be very thin, and stains of a darker colour (*Parazoanthus dixoni*, Pl. LIX., fig. 9), or it may be thick, in which case it rarely stains, and is often impregnated with dirt (*Epizoanthus wrightii*, Pl. LIX., fig. 3).

As the cuticle is an ectodermal secretion in forms with a continuous ectoderm, and, as the peripheral layer of mesoglœa must also be of ectodermal origin, and is, as a matter of fact, often indistinguishable from the cuticle, we do not consider it of any importance to discriminate between them in the forms with discontinuous ectoderm.

The above-mentioned layer of mesoglœa, peripheral to the ectoderm, is that which is called the subcuticle by Andres (**1877**, p. 222).

The ectoderm usually contains nematocysts, which M^cMurrich and others have failed to observe. As a rule these do not stain readily. In some species they are clear; in others—*e. g. E. norvegicus* (Pl. LIX., fig. 5), where they are, by-the-by, unusually numerous—they contain pigment granules. In *E. paguriphilus* they are very dark; often they have a yellowish colour, and are somewhat opaque.

Zooxanthellæ are present in the ectoderm of the three species of Isaurus which have been microscopically examined, and in many other species of the Brachycneminæ, but apparently not in all. We have not found them in any of the Macrocneminæ.

Incrustations.—The incrustations which form such a characteristic feature of this group of Actiniæ are absent in the genera Zoanthus and Isaurus, though very rarely a stray spicule, or grain of sand, may be entangled in the cuticlar layer of these genera.

With regard to the other genera, according to our experience, it appears that certain species have a proclivity for a particular kind of incrustation. The character of the incrustation must be conditioned by the precise habitat, *i.e.* whether sand-grains are calcareous or siliceous, or, again, whether the bottom is sandy or stony; if sponges are abundant on a rocky bottom (as, for example, in Albany Pass, Torres Straits), the forms will probably largely make use of sponge-spicules, as in *Parazoantha douglasi.* The best example we have of apparent selection is in the case of *Epizoanthus incrustatus;* of this species we have cut specimens from Norway, Shetland, West of Ireland, and N. E. America (*E. americanus*, Verrill), and in all cases we find the incrustations to be composed almost entirely of grains of sand. In the single specimen we have been able to examine, of *E. macintoshi*, from Shetland, the incrustations are almost entirely Foraminifera. In Norman's type specimens of *Parazoantha anguicoma*, from Shetland, the incrustations include grains of sand, Foraminifera, and sponge spicules; this holds good for the same species from the West of Ireland, as well as for the other species (*P. dixoni*) from the same district.

The amount of incrustation also varies—for example, the species of Epizoanthus are usually thickly incrusted, but in *Epizoanthus paguriphilus* the incrustations are very few in number. In *Parazoanthus dichroicus* there are very numerous incrustations, but in *P. axinellæ* they are sparse, and in *P. dixoni* there are still fewer.

Mesoglœa.—The mesoglœal ground substance is always homogeneous; it is penetrated by numerous minute cells, which are sometimes star-shaped, but more frequently produced at each end into a long fibril which extends in a radial direction. Some of these fibrils are undoubtedly connected with the ectoderm, and others with the endoderm (Pl. LXIV., fig. 1)*; it is impossible to determine whether some may not stretch right across the mesoglœa. We have not been able to satisfy ourselves of their presence in every case (ex. *E. wrightii*).

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* Plates LXI. to LXIV. will be found in the Memoir of these Transactions immediately succeeding this one, viz. that on the Zoantheæ of Torres Straits. They are frequently referred to in the present account of the anatomy of the group.

Cell enclosures.—Large ectodermal canals, penetrating the mesoglœa, are very characteristic of the genus Zoanthus; they also occur in Parazoanthus. In *Z. coppingeri* there are numerous large anastomosing canals which arise from the ectoderm (Pl. LXII., fig. 1), and have a general radial direction; many of the canals pass into the mesenteries.

In Isaurus the canals are relatively much smaller than in Zoanthus, and are more broken up than in *Z. coppingeri*, and undoubtedly have an endodermal as well as an ectodermal origin (Pl. LXIII., figs. 5 and 6).

The chief feature of the canal system in Parazoanthus is the presence of an encircling sinus, which lies just beneath the endoderm, and extends throughout the whole body-wall. This sinus is not everywhere continuous, but is frequently crossed by bars of mesoglœa (Pl. LIX., fig. 8). It is connected with the ectoderm by radial, occasionally branched canals. In *P. anguicoma* and *P. dixoni*, and in some other species, very fine canals connect the sinus with the endoderm (Pl. LIX., fig. 9). Although the encircling sinus may have connexions with the endoderm, these are very delicate, and the sinus itself is undoubtedly of ectodermal origin. The encircling sinus is the same as the "ring-canal" described by Erdmann in his "sp. 8 Palythoa sp." (**1885**, p. 469). [This is the *Palythoa anguicoma* of Hertwig, which we believe to be another species, for which we would suggest the name *Parazoanthus hertwigi.*] Nematocysts are present in the canals of many of the species of Zoanthus and Parazoanthus; possibly they are of universal occurrence in the canals.

In *Gemmaria macmurrichi* a somewhat similar encircling sinus is present, but it is very largely broken up by the mesoglœa into a number of vertical canals which appear in transverse section as a series of lacunæ, each one lying immediately below the union of a mesentery with the body-wall (Pl. LXIII., fig. 7). These vertical canals are often connected by finer ones.

Lacunæ are found in all the genera of the Zoantheæ except Epizoanthus and Sphenopus. In Zoanthus it appears that the canals are more or less broken up to form the lacunæ, least so in *Z. coppingeri* and *Z. danæ* (as identified by Hertwig), and most so in *Z. jukesii* (Pl. LXII., fig. 2), in which species continuous canals are rare; the same also obtains in *Isaurus asymmetricus*. In Palythoa there are no continuous canals; but lacunæ are present, as these are so similar to those which we know to be of ectodermal origin in other species; and as nematocysts are present, we believe that these lacunæ are of ectodermal origin (Pl. LXIII., figs. 8 and 9).

Small groups of cells, irregularly scattered in the mesoglœa, are especially characteristic of the genus Epizoanthus; they may be very numerous, as in *E. paguriphilus* (Pl. LIX., fig. 6), and in some of the species described by Erdmann, but in other species, *E. incrustatus*, *E. couchii*, and *E. wrightii*, they are very rare. They are abundant in the *Parazoanthus dichroicus*, and are also common in *P. anguicoma*, and *P. douglasi*. They occur also in *Gemmaria macmurrichi*, *Palythoa howesii*, and *P. kochii*.

We have no proof that these small and isolated groups of cells, which have been aptly termed "cell-islets" ("Zellinseln") by Erdmann, are connected in any way with the canals or the lacunæ, and, like that investigator, we do not know their origin. We regard these islets as simply groups of ordinary mesoglœal cells.

Endodermal and ectodermal bays.—We may here refer to the endodermal bays described for *Isaurus* [" *Mammillifera* "] *tuberculatus* by McMurrich (**1889**, p. 118); he says: "In some of my sections deep bays can be seen running from the endoderm into the mesoglœa, and from their ends and sides numerous canaliculi can be seen branching out. These bays can be found in various states of enclosure by the mesoglœa, the cells which they contain being in some cases continuous with the general endoderm, in other cases almost separated from it, and finally quite so. So, too, with the ectoderm." We have found similar deep endodermal bays in *Isaurus asymmetricus* (Pl. LXIV., fig. 9), but in no case were the bays quite separate from the general endoderm. In our species the ectodermal bays (Pl. LXII., fig. 4) differ considerably from those of McMurrich's species; the latter we have been able to examine through the courtesy of our friend, and as he has not figured one of these bays we add one for comparison (Pl. LXIII., fig. 3).

Endoderm.—The endoderm of the body-wall presents few features worthy of remark. In *I. asymmetricus* we have found nematocysts smaller than those which occur in the ectoderm. Zooxanthellæ are present in the three species of Zoanthus from Torres Straits, and appear to be characteristic of this genus as well as Isaurus. They are also extremely numerous in *G. mutuki*, and are present in *Palythoa howesii* and *P. kochii*. In *Parazoanthus dixoni* the endoderm is thickened into ridges between the mesenteries, but in most cases it is of uniform thickness.

Diffuse endodermal muscle.—The base of the endoderm forms a feeble but complete muscular sheath; as the fibres run in a horizontal direction, the muscle is scarcely to be seen in transverse sections; in vertical sections (Pl. LIX., figs. 9 and 12) they are readily seen.

Sphincter muscle.—The diffuse endodermal muscle of the general body-wall becomes converted in the capitular region into a sphincter muscle, which in contraction causes the introversion of the corona and capitulum. The genus Parazoanthus is unique amongst the Zoantheæ in possessing an endodermal sphincter. This fact was first discovered by Erdmann (**1885**, p. 468), who made this a primary character in the definition of his interpretation of the genus Palythoa, of which he took *P. axinellæ* as the type. As we shall subsequently explain, Erdmann's genus Palythoa cannot stand; so we have erected the new genus of Parazoanthus in its stead. The infoldings of the endodermal sphincter, especially in its upper portion, are frequently so cut across by the razor in sections as to appear isolated, and thus the muscle might be supposed to be partly mesoglœal in character (Pl. LX., fig. 8). It is possible that this may actually occur to a very slight extent. In either case the distinction between Zoantheæ with an endodermal and a mesoglœal sphincter is not so fundamental as might appear at first sight.

All other Zoantheæ have a mesoglœal sphincter. In Sphenopus the sphincter is extremely long, as Erdmann has previously remarked; Zoanthus alone has a double sphincter (Pl. LXIV., figs. 3 and 5).

Capitulum.—The capitulum, as all authors have described, is thrown into ridges; these have a certain amount of specific value, but too much reliance should not be placed upon this character.

In all species the ectoderm retains its character as a continuous epithelium. In *Z. coppingeri* the ridges are crowded with nematocysts, but we do not find this of common occurrence.

Tentacles.—The ectoderm of the tentacles contains numerous sausage-shaped nematocysts. The deeper layer of the ectoderm usually exhibits a well-marked nervous layer, the nerve-cells of which are shown in Pl. LXIV., fig. 2. There is a diffuse ectodermal muscular sheath, the fibres of which have a longitudinal direction.

The mesoglœa is usually thin. The endoderm is relatively thick; and in *Z. coppingeri*, *Z. jukesii*, and *Z. macgillivrayi* zooxanthellæ are here especially abundant, but in *I. asymmetricus* and in *Palythoa howesii* and *P. kochii*, although they are present in the endoderm of the body-wall, few, if any, are to be found in this region. In *Z. coppingeri* numerous nematocysts of oval shape, similar to those found in the ectoderm of the body-wall, are present in the endoderm of the tentacles (Pl. LXIV., fig. 2). And in some of our specimens of *E. couchii* similar nematocysts are to be found in the ectoderm of the tentacles. A diffuse endodermal muscular layer consisting of fibres which run in a circular or horizontal direction, and which may be regarded as an extension of the muscular layer of the body-wall, is found in the tentacles of all our species.

Disc.—The structure of the disc is usually similar to that of the tentacles. As in the latter, there are no incrustations.

Œsophagus.—The ectoderm of the œsophagus is usually more or less folded; but as the degree of folding is variable in different individuals of the same species, and probably also in the same individual in different conditions of contraction, this character is of little value for systematic purposes. The same may be said of the nature and extent of the groove. A sulcar groove is always present, but it is scarcely discernible in our specimens of *I. asymmetricus*, and in one of the specimens of *E. incrustatus* (Pl. LX., fig. 1). In other specimens of the latter species it is, however, distinct. Nematocysts are found in the ectoderm of the œsophagus of *Palythoa cæsia* (?), *E. couchii*, and *E. arenaceus.*

The mesoglœa of the œsophagus is generally thin, but in many species of Epizoanthus and of Parazoanthus it is much thickened in the groove. Cell enclosures are generally absent in this region, but we have seen a few cell-islets in the mesoglœa of the groove of *P. anguicoma* (one specimen), and they are also present in that of *P. dichroicus.*

Mesenteries.—The mesenteries which are such a valuable aid to classification of the Actiniæ generally are arranged in this group in a very uniform manner, which we have already described.

Imperfect mesenteries.—The imperfect mesenteries vary in the extent to which they project into the cœlenteron. In *E. incrustatus*, and in *Parazoanthus douglasi* they are very small, whereas in *P. dixoni* they are well developed. When canals are present in the perfect mesenteries they are also to be found in the imperfect.

Perfect mesenteries.—There is no distinction between any of the perfect mesenteries.

Ectoderm.—The presence of ectoderm in certain mesenteries of the Anthozoa appears to be now fairly well established. E. B. Wilson ("Mesenterial Filaments of the Alcyonaria": Mitth. Zool. Stat. Neapel, v. 1884) came to the conclusion that the "dorsal" pair of filaments in the Alcyonaria were ectodermal in origin, but that the other six filaments were solely endodermal; these two kinds of filaments can be readily distinguished histologically. Some years previously von Heider (*Cerianthus membranaceus*, Haime: Sitz. kais. Acad. Wien, lxxix. 1879) believed, solely from a histological study of the adult Cerianthus, that the filaments of that form were ectodermal. The Brothers Hertwig (Die Actinien, 1879) pointed out that embryological deductions based on adult histology were not very reliable, and also brought forward, as an objection to von Heider's view, the existence of filaments on imperfect mesenteries in the Actiniæ generally. H. V. Wilson (Journ. Morph. II., 1888) has shown for the coral Manicina, and J. P. M^cMurrich (*ibid.* IV. 1891) for the Actinian, Rhodactis, that the mesenterial filaments are derived from the ectoderm of the œsophagus.

From the histological characters and absolute continuity of what we have termed the "reflected ectoderm" of the mesenteries with the ectoderm of the œsophagus on the one hand, and with the mesenterial filament (craspedum) on the other, we have no doubt as to the morphological identity of these tissues.

Reflected Ectoderm and Filaments.—The mesenteric ectoderm consists of two portions, an upper, which we speak of as the "reflected ectoderm," and a lower portion, which runs down the edge of the mesentery, and is known as the mesenterial filament, or "craspedum" of Gosse. These two are perfectly continuous with each other and with the ectoderm of the œsophagus.

In looking at a side view of a mesentery such as that of *Z. macgillivrayi* (Pl. LXIV., fig. 5) it will be seen that the ectoderm of the œsophagus passes continuously on to the mesentery where it suddenly becomes greatly thickened, and is thrown into transverse folds; the whole thickening has a crescentic form, first coming upwards and then downwards losing itself in the mesenterial filament. The ectoderm is reflected on both sides of every one of the perfect mesenteries (Pl. LX., fig. 6), and presents a very characteristic appearance in transverse sections (Pl. LXIV., figs. 4 and 6). The folds often present a pinnate appearance, but they are rarely accurately symmetrical on each side.

In some species the endoderm is implicated in the upward reflection of the lower edge of the œsophagus; this is especially noticeable in *Parazoanthus axinellæ* (Pl. LX., fig. 6), but it is not a feature of any morphological importance.

As above mentioned the reflected ectoderm passes gradually into the mesenterial filament. The characteristic trefoil (*P. axinellæ*) (Pl. LX., fig. 6) or V-shape (*Z. macgillivrayi*) (Pl. LXIV., fig. 7) of the latter in transverse sections is continuous with the peripheral pair of folds of the reflected ectoderm.

The lateral elements of the upper portion of the craspedum gradually become shorter, so that eventually only the median portion is left (Pl. LX., fig. 7). This transition takes place very shortly below the lower level of the œsophagus.

Nematocysts are numerous in the simple lower portion of the mesenterial filament; but they are not readily seen in the upper portion, and we have not observed any in the reflected ectoderm. Unicellular glands and pigment granules also occur in the filament.

The length of the craspeda varies even in the same genus, it apparently being dependent upon the height of the polyp; for example in *Z. jukesii*, which is a short species, the filaments extend nearly down to the commencement of the cœnenchyme, whereas in *Z. macgillivrayi* they cease about half way down the polyp.

Mesoglœa.—The mesoglœa of the mesenteries exhibits a certain amount of variation in thickness; for example, in the œsophageal region of *Parazoanthus dixoni* (Pl. LX., fig. 9), the mesoglœa is relatively thick, whereas in *Epizoanthus paguriphilus* (Pl. LX., fig. 5) it is quite thin.

Canals.—In describing the canals in the mesoglœa of the body-wall, we have already alluded to the fact that in the three species of the genus Zoanthus from Torres Straits which we have examined, they not only arise from the ectoderm, but pass into the mesenteries.

Hertwig (**1882**, p. 115) describes in *Z. danæ* (?) (*cf.* **1888**, p. 36) a basal "septal canal" "in the supporting lamella of the septa in immediate proximity to the wall." He "never could make out any connexion between this septal canal and the ectodermal cords [*i. e.* canal system] of the wall"; and he is "inclined to believe that it is produced from the endoderm." His reason is that the zooxanthellæ, which are found in the mesenteric canal of this species, "force their way into the septal canal, but never into the canals of the wall." According to our experience there are no connexions between the canal-system of the body-wall and the mesenteric canals in the œsophageal region of the body, although they are numerous lower down. The section Hertwig figures is from the œsophageal region.

M^cMurrich (**1889 A**, p. 64) finds in *Z. sociatus*, in "one mesentery, the basal canal communicating with one of the spaces in the mesoglœa of the column wall." He adds: "It seems open to question whether the cells of the larger cavities in the mesoglœa are not in reality endodermal in their origin." In his subsequently written, but previously published Paper (**1889**, p. 114), in alluding to the body-wall canals of *Z. flos-marinus*, he refers the reader to his description of *Isaurus* ["*Mammillifera*"] *tuberculatus* for his views as to the origin of these canals, evidently believing that the "endodermal bays" of the latter species give rise to some of the canals, the remainder being similarly derived from the ectodermal bays, and then not unnaturally concludes that the mesenteric canals are connected only with the endodermal "spaces" of the body-wall. We have corroborated M^cMurrich's observation as to the double origin of the canal-system in the body-wall of Isaurus; but we have no reason for supposing that the canals in the mesenteries are without exception of endodermal origin, although some undoubtedly are (Pl. LXIII., fig. 5). Our experience leads us to the conclusion that it is necessary to be cautious in arguing as to the origin of these canals from one genus to another. For confirmation of our view, that the mesenteric canals of Zoanthus are of ectodermal origin, we point to the demonstration of this fact for *Z. coppingeri* (Pl. LXII., fig. 1).

In *Z. coppingeri* the canals form at the base of each mesentery a large sinus, which extends up the mesentery, nearly to the generative region, where it rapidly narrows, and extends right up the mesentery as the "basal canal." In *Z. jukesii* and in *Z. macgillivrayi* the mesenteric canals are present, though not forming extensive sinuses (Pl. LXII., fig. 2).

In *I. asymmetricus* the canal system appears in sections as if broken up into lacunæ; but it may really form a continuous system of anastomosing canals.

In *Gemmaria rusei* (**1889**, p. 125) and *G. isolata* (**1889 A**, p. 66) the mesenteric canal, according to M^cMurrich, has the character of a basal canal. We find the same in our two species. Sinuses, extending throughout the whole length of the mesenteries, occur in the three species of Palythoa we have examined. So far as our experience goes canals are absent from the mesenteries of Epizoanthus, and the same obtains for all the species of Parazoanthus except *P. anguicoma* and *P. dixoni*, in which species we have found sinuses in the bases of the mesenteries which have a slight vertical extension.

In *Parazoanthus dichroicus* cell-islets occur in the mesoglœa of the mesenteries, and also in *E. paguriphilus.*

Nematocysts are sometimes present in the canals and sinuses of the mesenteries (*e.g. Z. coppingeri* (Pl. LXII., fig. 1) and *Palythoa howesii*); but zooxanthellæ are rarely present. We have found them in *Palythoa kochii.*

Endoderm.—The endoderm of the proximal portion of the mesenteries usually resembles that of the body-wall, except that it more frequently contains nematocysts, as in *Z. coppingeri*, *Z. macgillivrayi*, and *I. asymmetricus.* In the latter species they are much smaller than those of the ectoderm of the body-wall. Zooxanthellæ occur in the endoderm of the mesenteries in those species in which they are present in the general endoderm.

M'Murrich has carefully described the swollen distal portion of the endoderm of the mesenteries of *Z. flos-marinus* (**1889**, p. 115, Pl. vii., fig. 4) in that region of the body where the mesenterial filament is simple. We have found a similar enlargement in *Z. macgillivrayi* (Pl. LXIV., fig. 8), in which nematocysts are present. Our specimen differs from his chiefly in the possession of zooxanthellæ and nematocysts; we have not observed in our species that these endodermal cells are "loaded with green granules, closely packed together."

A similar swelling occurs, to a variable extent, in other species; for example, in *P. axinellæ* (Pl. LX., fig. 7) it is only moderately developed, and we have not observed nematocysts or zooxanthellæ; but these appear to be absent in the general endoderm of this species. Sometimes the swelling is absent, as in *E. incrustatus.*

We, too, have found, with M'Murrich, "foreign bodies of organic nature imbedded in the cells, sometimes being surrounded by a number of cells containing no granules, or occasionally imbedded in the mesoglœa" (**1889**, p. 116). He suggests that these are concerned with digestion (Pl. LXIV., fig. 8).

Muscles.—The muscles of the mesenteries are endodermal and diffuse. As in other Actiniæ there are two kinds of muscles, the longitudinal and the parieto-basilar.

The longitudinal muscle is often very difficult to distinguish in transverse section, being feebly developed, and forming a simple layer of fibres (Pl. LXIV., fig. 8). In *I. asymmetricus* and *E. paguriphilus*, *Parazoanthus dixoni*, and others, the muscle is better developed, and is slightly plaited (Pl. LX., fig. 9).

The parieto-basilar muscle is usually relatively broader, and extends higher up the mesenteries than in other Actiniæ; but in *Parazoanthus anguicoma* and *P. dixoni*, this muscle is very feebly developed, and only occurs at the insertion of the mesenteries (Pl. LX., fig. 9).

It has been recognized by other investigators that judging by the arrangement of the muscles the mesenteries of the Zoantheæ are paired, although the two elements of each pair are respectively a perfect and imperfect mesentery, and are independently developed. Recently, however, Danielssen (1890) has thrown doubt upon this paired arrangement, since he finds in the various species he has examined that the muscles are equally developed on both sides of the perfect mesenteries. Owing to the kindness of our Norwegian colleague we have been enabled to examine some specimens of *Epizoanthus* [" *Mardœll* "] *erdmanni*, and our sections show this paired arrangement quite clearly.

Gonads.—There appears to be a general impression that all the Zoantheæ are hermaphrodite. This is certainly not the case in four genera; of one genus we have no facts either way, and in the the remaining two genera the sexes may be distinct or united. Generative organs often appear to be absent in specimens of Zoantheæ, but we have been somewhat fortunate in finding them in those we have examined. Their mode of occurrence will be seen on reference to the Plates in this and in the Memoir on the Zoantheæ from Torres Straits.

Erdmann found that the two species of Zoanthus which he examined (" 1 sp. Zoanthus sp. ?," p. 438 (= *Z. danæ* [?], Hertwig); and " 2 sp. Z. sp. ?," p. 447) were hermaphrodite, so he concluded that this was a generic character. M^cMurrich found no generative organs in the two species he examined. Of the three species we have examned, two specimens of *Z. coppingeri* were male and three were female; two specimens of *Z. jukesii* were female, and of the four specimens of *Z. macgillivrayi* we sectionized none were fertile. The conclusion we arrive at is that the genus is as often diœcious as monœcious.

M^cMurrich found that *Isaurus* [" *Mammillifera* "] *tuberculatus* was hermaphrodite, and owing to his courtesy we have been enabled to verify this fact. We have cut several specimens of our *I. asymmetricus*, but in only one of them could we discover generative organs, and in this case they were feebly developed ova. We cannot, however, assume that the genus is hermaphrodite because one species is undoubtedly monœcious.

All the remaining genera, so far as is known, are diœcious, except Sphenopus, the gonads of which are unknown.

Neither Erdmann nor M^cMurrich found generative organs in the five species of Palythoa (" Corticifera ") examined by them. We have been more fortunate, since in *P. kochii* we found male organs alone, and in *P. howesii* we found only female.

According to our experience all the members of a single colony of diœcious Zoantheæ belong to the same sex; but we cannot lay down any general rule on this point.

Cœnenchyme.—The structure of the cœnenchyme is similar in every respect to that of the polyps. The only difference consists in the presence of cœlenteric canals, which are merely prolongations of the cœlenteron of the polyps.

The cœnenchyme may occur as stolons, more or less riband-like, or as flattened expansions, or, as in Palythoa, it may fill up the intervals between the polyps. Some zoologists have laid stress on the systematic value of the habit of growth of the cœnenchyme; but, as a matter of fact, we have often found that in the same species it varies according to the surface to which the colony is attached, and therefore cannot lay great stress on this character. The genus Gemmaria, as defined by McMurrich, precisely resembles Palythoa (his Corticifera), with the exception of the character of the cœnenchyme, it being absent or lamellar in the former. We consider this a legitimate use of the character of the cœnenchyme for taxonomic purposes.

The most interesting varieties of cœnenchyme occur amongst those species of Epizoanthus which incrust Gasteropod shells inhabited by hermit crabs. In these cases the cœnenchyme dissolves the lime of the shells, which it replaces by its own substance; and thus the carcinæcium practically forms an isomorph of the shell. The spire of the shell is the last portion to be absorbed. In describing the manner in which the polyps are arranged on the cœnenchyme, we employ the terms "dorsal," "ventral," "anterior," "posterior," "right," and "left;" these have reference solely to the position of the carcinæcium with regard to the crab when walking.

Development.—We have no account of the development of any Zoanthean, with the possible exception of an observation by Van Beneden (**1890**), who describes the anatomy of a larval Actinozoon allied to Semper's larva (Zeitschr. f. wiss Zool., xvii. 1867). He regards it as a larva of a "microtypal" (brachycnemic) Zoanthean, on account of the arrangement of the mesenteries. He adds: "What further confirms our opinion, that our larva and that of Semper may be connected with the development of the Zoantheæ, is that the constitution of the mesenchymatous lamella is particularly well developed, and provided with numerous cellular elements, of which some have an endodermic origin, the others being derived from the ectoderm" (p. 95). The senior author has very recently (Proc. Roy. Dub. Soc. (N. S.), vol. vii., pt. III., p. 127, 1891) published a small Paper on a larval stage of the coral Euphyllia, which presents many of the anatomical peculiarities which characterise Van Beneden's larva; it is only fair to add that in the newly-hatched larva of Euphyllia the mesoglœa is thin and without cell-enclosures.*

Parasites.—Some of our specimens of *Parazoanthus douglasi* from Albany Pass are infested by a Copepod which deposits its egg-capsule in the cœlenteron or cœlenteric canals of the Zoanthean. The capsules are paired, and contain a large number of ova. We have these in the nauplius stage, and in other stages of development. We have two specimens of the Copepod, but are unable to say whether these are adult or not. The capsules form distinct swellings (Pl. LXI., figs. 19–22) of the body-wall of the Actinian. This fact leads us to suppose that the Copepod remains within the cœlenteric cavities while the capsule is developing; and when the latter is ripe it breaks away from it.

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* Since the above was in type we have received, through the courtesy of the author, a valuable Paper on "The Phylogeny of the Actinozoa," by Professor McMurrich (1891), in which he gives an account, and four figures (Pl. IX., figs. 5–8), of two stages in the development of a brachycnemic Zoanthean. We regret we can do no more than draw attention to this Paper.

We have sections of a Crustacean in the cœlenteron of the only specimen of *Epizoanthus macintoshi* (from Shetland) we were able to cut, but we cannot say anything more about it.

Small, oval, deeply pigmented bodies occur in many parts of the body in *Parazoanthus dichroicus* and in *P. douglasi* (Pl. LXII., figs. 5 and 6). They are evidently parasites, but we have been unable to determine their nature.

Problematical rounded bodies, which stain deeply and uniformly with carmine, are present in *Z. macgillivrayi*, *Palythoa howesii*, and other species.

CLASSIFICATION OF THE GROUP.

ZOANTHEÆ.

Actiniæ with numerous perfect and imperfect mesenteries, and two pairs of directive mesenteries, of which the sulcar are perfect and the sulcular are imperfect. A pair of mesenteries occur on each side of the sulcular directives, of which the sulcular moiety is perfect and its sulcar complement is imperfect; a similar second pair occurs in one section of the group (Brachycneminæ), or the second pair may be composed of two perfect mesenteries (Macrocneminæ). In the remaining pairs of mesenteries, of both divisions, this order is reversed, so that the perfect mesentery is sulcar and the imperfect is sulcular. The latter series of mesenteries are bilateral as regards the polyp and arise independently (*i. e.* neither in pairs nor symmetrically on each side) in the exocœle on each side of the sulcar directives, in such a manner that the sulcular are the oldest and the sulcar the youngest. Only the perfect mesenteries are fertile or bear mesenterial filaments. A single sulcar œsophageal groove is present. The mesoglœa of the body-wall is traversed by irregularly branching ectodermal canals or by scattered groups of cells. The body-wall is usually incrusted with foreign particles. The polyps are generally grouped in colonies connected by a cœnenchyme, the cœlenteron of each polyp communicating with that of the other members of the colony by means of basal endodermal canals.

Family. ZOANTHIDÆ, Dana, 1846.

(With the definition of the group.)

Sub-family. BRACHYCNEMINÆ, n. s.-f.*

Zoantheæ in which the sulcar element of the primitive sulco-lateral pair of mesenteries (cnemes) is imperfect:—

GENERA AND TYPE SPECIES.

ZOANTHUS,	Lamarck.	Type *Z. sociatus* (Ellis).
ISAURUS,	Gray.	„ *I. tuberculatus*, Gray.
(? MAMMILLIFERA,	Lesueur.	„ *M. auricula*, Lesueur.)
GEMMARIA,	Duchassaing et Michelotti.	„ *G. rusei*, Duch. and Mich.
PALYTHOA,	Lamouroux.	„ *P. mammillosa* (Ellis and Sol.).
SPHENOPUS,	Steenstrup.	„ *S. marsupialis*, Steenstr.

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* βραχύς, short; μακρός, long; κνήμη, a radius or spoke of a wheel. We have tried hard to discover a short term for a mesentery, which would readily lend itself to combination with other words, but without

Sub-family. MACROCNEMINÆ, n. s.-f.*

Zoantheæ in which the sulcar element of the primitive sulco-lateral pair of mesenteries (cnemes) is perfect:—

GENERA AND TYPE SPECIES.

EPIZOANTHUS, Gray.	Type *E. incrustatus* (Düb. and Kor.).
PARAZOANTHUS, n. g.	„ *P. axinellæ* (Schmidt):

The Zoantheæ constitute a very well-marked division of the Actiniæ; no connecting forms between these and any other group are known.

The classification of the Zoantheæ proposed by Erdmann has been adopted by all subsequent writers; and as his was the first which was based on internal anatomy, we need not enter into a discussion of the earlier systems.

Erdmann adopts Andres' two families, the Zoanthidæ and the Sphenopidæ, with the following definitions:—"Zoanthidæ: Zoantheen, welche durch ein Cœnenchym zu Colonien vereinigt werden;" and "Sphenopidæ: Einzellebende Zoantheen, welche mit ihren abgerundeten Körperende im Sande stecken oder mit einer Art Haftscheibe am Boden festsitzen." It is strange that these families should be based solely upon the habit of growth. In the second family he places Sphenopus and his "genus novum"; the latter is undoubtedly the free (or Sidisia) variety of an Epizoanthus. It is very probable that this is really the free-variety of the type species of Epizoanthus (*E. incrustatus*). As this form passes out of the family we see no reason for retaining a family for Sphenopus, especially as an isolated mode of growth occurs in the other family, as McMurrich has shown that *Gemmaria rusei* is "solitary, being attached to pebbles without the development of any cœnenchyme" (1889, p. 124), and the individuals of his *G. isolata* "were scattered and buried up to the tentacles in the sand" (1889 A, p. 65); and it is characteristic of the genus Isaurus for the polyps to be either solitary, or in small groups with a feeble cœnenchyme. We therefore think it preferable to base divisional characters on anatomical differences.

McMurrich has adopted Andres' three divisions, the third being the Bergidæ. As nothing is known about the structure of the latter we think it better to omit them altogether.

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success. The objection to the word "cneme" is that it has reference to the appearance of a transverse section of an Actinian rather than to a mesentery as it actually exists. As the investigation of the Zoantheæ, at least, must principally be made by means of transverse sections, this objection has not much weight.

* *Ibid.*

We acknowledge only one family in the group which we divide into two sub-families, the Brachycneminæ, and the Macrocneminæ, which are based upon the two well-known types of mesenterial arrangement. It is worthy of notice that, so far as our knowledge at present extends, the Macrocneminæ alone are represented in the North Atlantic, although they are world-wide in distribution.

The following Table shows the chief generic distinctions at a glance, and demonstrates that the group is a very homogeneous one. We regard Parazoanthus as being the least specialised genus on account of its having a single endodermal sphincter muscle, and Zoanthus as the most specialised, as it possesses a double mesoglœal sphincter muscle. We omit Mammillifera, as the type species have never been described from an anatomical point of view:—

Genus.	Mesenterial arrangement.	Sphincter.	Gonads.	Body-wall and Cœnenchyme.
Zoanthus.	Brachycnemic.	Double mesoglœal.	⚥ or ♂, ♀	Unincrusted; well-developed ectodermal canal system.
Isaurus.	Brachycnemic.	Single mesoglœal.	⚥ or ♂, ♀	Unincrusted; ectodermal and endodermal bays and small canals; sometimes solitary.
Gemmaria.	Brachycnemic.	Single mesoglœal.	♂, ♀	Incrusted; lacunæ; often solitary, always attached.
Palythoa.	Brachycnemic.	Single mesoglœal.	♂, ♀	Similar to above, but polyps immersed in expanded cœnenchyme.
Sphenopus.	Brachycnemic.	Single mesoglœal.	?	Incrusted; cell-islets; always solitary and free.
Epizoanthus.	Macrocnemic.	Single mesoglœal.	♂, ♀	Incrusted; cell-islets.
Parazoanthus.	Macrocnemic.	Endodermal.	♂, ♀	Incrusted; ectodermal canals; cell-islets; encircling sinus; ectoderm always continuous.

In the following list we have enumerated immediately after the generic description all the species which can be definitely referred to any species, adding in brackets [ ] the initials of the zoologists who have investigated those forms, and on whose authority the generic allocations are made. The initials are as follows:—A., Andres; E., Erdmann; E. & H., Erdmann and Hertwig, for those species described in the Supplement to Hertwig's "Challenger" Report, 1888, the anatomical work on the Zoantheæ being done by Erdmann; H., Hertwig (1882); H. & S., Haddon and Shackleton; M., McMurrich. Although other zoologists have made anatomical investigations on some forms, yet in no other case is there sufficient information given to enable one to determine the generic position of a particular species.

In a few instances we have added those species which we think may safely be regarded as probably belonging to a particular genus, *e.g.* Palythoa and those species of Epizoanthus which form carcinæcia, owing to their having a similar habit of growth to species whose genus is known. Beyond this we have not dared to go, as enough confusion has been made in the group without our gratuitously adding to it.

Family. ZOANTHIDÆ.

Sub-family. BRACHYCNEMINÆ.

ZOANTHUS, Lamarck, 1801.

Brachycnemic Zoantheæ, with a double mesoglœal sphincter muscle. The body-wall is unincrusted; the ectoderm is usually discontinuous; well-developed ectodermal canal system in the mesoglœa. Monœcious or diœcious. Polyps connected by thin cœnenchyme.

RECOGNIZED SPECIES.

Z. sociatus (Ellis), 1767.—Dominica, Barbadoes, Guadeloupe, Bahamas, [M.].
Z. flos-marinus, Duch. & Mich., 1860.—St. Thomas, Bermudas, [M.].
Z. danæ (?), of Hertw., 1888.—Bermudas (? if the same as *Z. danai*, Le Conte, 1851, Panama), [E. & H.].
Z. confertus, of Hertw., 1888.—Cape of Good Hope (? if the same as *M. conferta*, Verrill, 1868, San Salvador, Acapulco), [E. & H.].
Z. coppingeri, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
Z. jukesii, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
Z. macgillivrayi, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
Z. sp. (?), Hertw., 1882.—Bermudas, [H.].

ISAURUS, Gray, 1828.

Large brachycnemic Zantheæ, with a single mesoglœal sphincter muscle. The body-wall is unincrusted; the ectoderm is discontinuous; ectodermal and endodermal bays and small canals in the mesoglœa. Monœcious or diœcious. Polyps in small clusters or solitary.

RECOGNIZED SPECIES.

I. tuberculatus, Gray, 1828.—Guadeloupe, Bermudas, [M.].
I. spongiosus (Andres), 1877.—Port Natal, [A.].
I. asymmetricus, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].

PROBABLY BELONGING TO THIS GENUS.

I. cliftoni (Gray), 1867.—W. Australia.

[? MAMMILLIFERA,* Lesueur, 1817.

M. auricula, Lesueur, 1817.—St. Vincent; Dominica.
M. nymphœa, Lesueur, 1817.—St. Christopher.]

GEMMARIA, Duchassaing et Michelotti, 1860.

Solitary brachycnemic Zoantheæ, with a single sphincter mesoglœal muscle. The body-wall is incrusted with particles of sand. The ectoderm is usually discontinuous, but may be continuous. Lacunæ and cell-islets are found in the mesoglœa. Diœcious.

RECOGNIZED SPECIES.

G. rusei, Duch. & Mich., 1860.—St. Thomas, Bermudas, [M.].
G. isolata, McMurr., 1889.—Bahamas, [M.].
G. macmurrichi, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
G. mutuki, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].

PROBABLY BELONGING TO THIS GENUS.

G. philippinensis (Gray), 1867.—Philippines.

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* The position of this genus cannot be settled until the type species have been recovered and sectionized.

PALYTHOA, Lamouroux, 1816.

Brachycnemic Zoantheæ, with a single mesoglœal sphincter muscle. The body-wall is incrusted; the mesoglœa contains numerous lacunæ, and occasionally canals. Diœcious. Polyps immersed in a thick cœnenchyme.

RECOGNIZED SPECIES.

P. mammillosa (Ellis & Sol.), 1786.—Jamaica, = *Corticifera lutea* of Hertwig, 1888.—Bermudas, probably not *C. lutea*, Quoy & Gaim., 1833.—Tongatabou, [E. & H.].
P. ocellata (Ellis & Sol.), 1786.—Dominica, Jamaica, [M.].
P. glareola (Lesueur), 1817.—Guadeloupe, Bermudas, [M.].
P. flava (Lesueur), 1817.—St. Thomas, Bahamas, [M.].
P. tuberculosa, of Hertwig, 1888.—Cape of Good Hope; probably not *P. tuberculosa*, Klunz., 1877.—Red Sea, [E. & H.].
P. howesii, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
P. kochii, Hadd. & Shackl., 1891.—Torres Straits, [H. & S.].
P. cæsia ?, Dana (*fide* H. & S., 1891).—Torres Straits, [H. & S.].

THE FOLLOWING PROBABLY BELONG TO THIS GENUS:—

P. aggregata (Lesson.), 1830.—Society Archipelago.
P. lutea (Quoy & Gaim.), 1833.—Tongatabou.
P. flavo-viridis, Ehr., 1834.—Red Sea.
P. argus, Ehr., 1834.—Red Sea.
P. cæsia, Dana, 1846.—Fiji.
P. glutinosa, Duch. & Mich., 1866.—St. Thomas, probably = *P. ocellata*, (E. & S.).
P. caribæorum, Duch. & Mich., 1866.—St. Thomas.
P. cinerea, Duch. & Mich., 1866.—St. Thomas.
P. tuberculosa, Klunz., 1877.—Red Sea. Probably neither of Hertwig nor of Studer, 1878.—New Ireland.
P. calcaria, Müll., 1883.

SPHENOPUS, Steenstrup, 1856.

Free solitary brachycnemic Zoantheæ, with a single, very long mesoglœal sphincter muscle. The body-wall is incrusted. Cell-islets are present in the mesoglœa.

RECOGNIZED SPECIES.

S. marsupialis, Steenstr., 1856.—Tranquebar, Pulo Faya, China Seas, Gray; (? Madras, H. & S.), [H. & S.].
S. marsupialis, var. *bursiformis*, Gray, 1867.—Massachusetts Bay, N. America. (This requires confirmation.)
S. arenaceus, Hertw., 1882.—Cape York, [H.].
S. pedunculatus, Hertw., 1888.—Philippine Islands, [E. & H.].

Sub-family. MACROCNEMINÆ.

EPIZOANTHUS, Gray, 1867.

Macrocnemic Zoantheæ, with a single mesoglœal sphincter muscle. The body-wall is incrusted. The ectoderm is usually continuous, but may be discontinuous; cell-islets in the mesoglœa. Diœcious polyps, connected by cœnenchyme, which may be band-like, incrusting, or greatly reduced, as in the free forms.

RECOGNIZED SPECIES.

E. incrustatus (Düb. & Kor.), 1847.—Norway, [H. & S.], = *E. papillosus* (Johnst.), 1842.—W. coast of Britain, [H. & S.], = *Sidisia barleei*, Gray, 1858 (free variety).—Shetlands, [H. & S.], = *E. americanus*, Verr., 1864 (and free variety).—E. coast of N. America, [H. & S.], = *E. cancrisocius* of Hertw. (not of Studer), 1888.—Nova Scotia, [E. & H.].
E. arenaceus (D. Ch.), 1836.—Mediterranean, [H. & S.].
E. couchii (Johnst.), 1838.—S. W. Britain, [H. & S.].
E. norvegicus (Kor. & Dan.), 1877.—Norway, [H. & S.].

E. paguriphilus, Verr., 1882.—E. coast of N. America; W. coast of France; W. coast of Ireland, [H. & S.].
E. parasiticus, of Hertw., 1882.—Japan (probably not of Verrill, 1862), [H.].
E. thalamophilus, Hertw., 1888.—Valparaiso, [E. & H.].
E. stellaris, Hertw., 1888.—Philippines, [E. & H.].
E. elongatus, Hertw., 1888.—Monte Video, [E. & H.].
E. erdmanni (Dan.), 1890.—N. coast of Norway; Spitzbergen, [H. & S.].
E. macintoshi, n. sp.—Shetlands, [H. & S.].
E. wrightii, n. sp.—Dublin Bay, [H. & S.].

PROBABLY BELONGING TO THIS SPECIES.

E. cancrisocius (Martens), 1875, ? of Studer, 1878.—Japan.
E. parasiticus, Verr., 1864.—E. coast of N. America.
E. abyssorum, Verr., 1885.—E. coast of N. America.
E. eupaguri (Mar.), 1882.

PARAZOANTHUS, n. g.

Macrocnemic Zoantheæ with a diffuse endodermal sphincter muscle. The body-wall is incrusted; the ectoderm is always continuous; the mesoglœa contains ectodermal canals, cell-islets, and an encircling sinus. Diœcious.

RECOGNIZED SPECIES.

P. axinellæ (Schmidt), 1862.—Mediterranean, [E.], [H. & S.].
P. anguicoma (Norm.), 1868.—Shetlands; W. Britain, [H. & S.].
P. dixoni, n. sp.—W. of Ireland, [H. & S.].
P. dichroicus, H. & S. 1891.—Torres Straits, [H. & S.].
P. douglasi, H. & S., 1891.—Torres Straits, [H. & S.].
P. (sp.)? (Hertw.), 1888.—Tristan d'Acunha, [E. & H.].
P. hertwigi, n. n.—Tristan d'Acunha, [E. & H.], name proposed by us (see p. 616) for *P. anguicoma*, of Hertwig, 1888.

SYSTEMATIC ACCOUNT OF THE BRITISH ZOANTHEÆ.

ZOANTHIDÆ.

I. BRACHYCNEMINÆ. (None British.)

II. MACROCNEMINÆ.

EPIZOANTHUS, Gray, 1867.

SPONGIA (pars), Johnston, 1834.
DYSIDEA ? (pars), Johnston, 1842.
MAMMILLIFERA (pars), Auct.
ZOANTHUS (pars), Auct.
SIDISIA, Gray, 1858.
CAROLIA, Gray, 1867.
POLYTHOA (pars), Andres, 1884.
PALYTHOA (pars), Carus, 1884.

Macrocnemic Zoantheæ, with a single mesoglœal sphincter muscle. The body-wall is incrusted; the ectoderm is usually continuous, but may be discontinuous; cell-islets in the mesoglœa. Diœcious. Polyps connected by cœnenchyme, which may be band-like, incrusting, or greatly reduced as in the free forms.

The genus Epizoanthus was established by Gray in 1867 for incrusted Zoantheæ: "II. coral attached; cells arising from a foliaceous expanded base. . . . The base expanded foliaceous (parasitic on shells); the cells cylindrical, simple, separate from each other from the base; tentacles numerous" (p. 237). *E. papillosus*, Johnst., is his type. Verrill adopted Gray's genus. At first Hertwig (**1882**) agreed with Verrill in using this term to denote incrusted forms which rose above their cœnenchyme. After Erdmann's investigations, he (**1888**) restricted the genus to macrocnemic Zoantheæ, with "Integument incrusted, cœnenchyme (mostly ?) lamellar; sphincter simple, mesoglœal; mesenteries arranged on the macrotype; colonies (mainly ?) parasitic" (p. 37). We have studied the type species of this genus, and find that it does conform to Erdmann's and Hertwig's definition of the genus. We may add that all observers have agreed in relegating to this genus all those incrusted Zoantheæ which form carcinæcia.

In 1858 Gray erected the genus Sidisia for free Zoantheæ, "which may be characterized by the emission of buds on the surface of the cylindrical body" (p. 532), *S. barleei* being the sole species. He considered that this species "evidently belongs to quite a different group" from *Dysidea papillosa*, Johnst., which Mr. Barlee (*in litt.*) informed Gray "was a Zoanthus, allied to the genus Mammillifera of Lesueur," an opinion which Gray adopted.

Our investigations prove that *S. barleei* is only a variety of *E. incrustatus* (= *E. papillosus*). We do not propose to keep the name Sidisia for the genus, although it has priority, and for this reason: it was solely erected for a species which is only a variety of an older form; and the name has only been occasionally retained for this variety of that particular species, whilst Epizoanthus has been universally adopted for the more typical forms of this genus. Both names were originated by Gray, and we have therefore less hesitation in keeping to the latter.

Erdmann examined some free Zoantheæ which were dredged by "H. M. S. 'Triton,' 640 Fuss" (**1885**, p. 481). Without paying any attention to the literature of the subject, he relegated these to a new genus, which he did not name. Very likely it is the Shetland species. Danielssen (**1890**) described specimens which he referred to Erdmann's new genus, which he named Mardœll; and he called his new species *M. erdmanni* (p. 117). Through the courtesy of Dr. Danielssen we have been able to examine this form, and have cut sections of it. We are perfectly satisfied as to its specific distinction from the free variety of *E. incrustatus.*

The imperfect mesenteries of *E. erdmanni* are much more developed than in *E. incrustatus;* and there is almost invariably a well-marked lacuna in the mesoglœa at the base of the insertion of each mesentery.

In every respect it is an Epizoanthus, the sphincter being mesoglœal instead of endodermal, as Danielssen states, and the arrangement of the mesenteries is macrocnemic, though Danielssen's figures do not show this.

BRITISH SPECIES OF THE GENUS EPIZOANTHUS.

E. incrustatus, Düb. & Kor., 1847.
E. couchii, Johnst., 1838.
(**E. rubricornis**, Holdsw., 1861.)
E. paguriphilus, Verr., 1882.
E. macintoshi, n. sp.
E. wrightii, n. sp.

SYNOPSIS OF BRITISH SPECIES OF EPIZOANTHUS.

Forming carcinæcia, .	One polyp ventral, remainder marginal, . . .	*E. paguriphilus.*
	Polyps on upper surface only, ...	*E. incrustatus.*
Free Colonies, . . .	Polyps radiating in one plane from a common point; diameter to height of polyp as 1 to 2, .	
	Polyps radiating in all directions from a common point; diameter to height of polyp as 1 to 4, .	(*E. rubricornis.*)
Incrusting Colonies, .	*a.* Cœnenchyme usually band-like, ...	*E. couchii.*
	Diameter to height of polyp as 1 to 4, . . .	(S. W. Ireland.)
	,, ,, ,, as 1 to 8, . . .	(S. W. England.)
	Cœnenchyme probably band-like; diameter of polyp nearly as great as height, ...	*E. macintoshi.*
	b. Cœnenchyme irregular; diameter of polyp greater than height, ...	*E. wrightii.*

The above relative proportions of diameter to height refers solely to contracted spirit specimens.

Epizoanthus incrustatus (Düb. and Kor.).

(Pl. lviii., figs. 1–22; Pl. lix., fig. 2; Pl. lx., fig. 1.)

Spongia suberia:

Johnston, 1834, Loudon's Mag. Nat. Hist., vii., p. 481, fig. 60.

Dysidea (?) *papillosa:*

Johnston, 1842, Hist. Brit. Sponges, pp. 190, 251 (in part), fig. 18 (not pl. xvi., figs. 6, 7), Gray, 1858, Proc. Zool. Soc., p. 531.

Mammillifera incrustata:

Düben and Koren, 1847, Forhandl. Skand. Naturf. Möde, p. 268 (*cf.* transl. in Isis, 1848, p. 586). Sars, 1851, Reise i Lofot. og Finm., Nyt Mag. Naturvid., vi. (2), p. 142. Danielssen, 1859, Nyt Mag. Naturvid., xi. (1861), p. 45.

Sidisia barleei:

Gray, 1858, Proc. Zool. Soc., xxvi., p. 532, pl. x., fig. 8. Gray, 1867, Proc. Zool. Soc., p. 237. Norman, 1868, Rep. Brit. Assoc. Adv. Sci., p. 319.

Zoanthus couchii:

(Not of Couch). Landsborough (in part), 1852, Brit. Zooph., p. 225. Holdsworth (in part), 1858, Proc. Zool. Soc., p. 557, pl. x., fig. 3; and 1859, Ann. Mag. Nat. Hist., (3), iv., p. 152. Var. *diffusa*, Gosse, 1860, Brit. Sea Anemones, p. 298, pl. ix., fig. 10; and var. *liber*, p. 298, pl. ix., fig. 9. Var. *M. incrustata*, Alder, Trans. Tyneside Nat. Field Club, v.

Zoanthus incrustatus:

Sars, 1860, Forhandl. Vidensk., Christiania, p. 141; also Forhandl. Skand. Naturf. de. Kjöb., viii., p. 691. Norman, 1868, Rep. Brit. Assoc. Adv. Sci., p. 319.

Epizoanthus americanus:

Verrill, 1864, Mem. Boston Soc. Nat. Hist., i., pp. 34, 45 (addenda); 1866, Proc. Boston Soc. Nat. Hist., x., p. 335 (*Gemmaria americana*, Verrill, Am. Nat., ii., p. 9, fig. 42) 1871, Am. Jour. Sci., ii., p. 361. Dana, 1872, Corals and Coral Islands (2nd ed.), p. 62, figs. 1, 2. Verrill, 1873, U. S. Fish. Com. Rep., pp. 446, 510, pl. xxxviii., figs. 286, 287; 1874, Am. Jour. Sci., vii., p. 413; *ibid.* (3), xxiii., 1882, p. 316. Smith and Harger, 1874, Trans. Connect. Acad., iii., pp. 9, 10, 11, 55, pl. viii., fig. 2. Verrill, 1883, Bull. Mus. Comp. Zool., xi., 1883–1885, p. 60, pl. viii., figs. 1, 6; 1885, U. S. Fish. Com. Rep. (1883), p. 534.

Epizoanthus papillosus:

Gray, 1867, Proc. Zool. Soc., 1867, p, 237. Ridley, 1886, Proc. Roy. Irish Acad. (2), iv., No. 5, Sci., p. 617.

Palythoa arenacea:

Carus, 1884 (not of D. Ch.), Prod. Faunæ Medit., p. 75.

Polythoa arenacea:

Andres, 1884 (not of D. Ch.), Le Attinie, p. 308. Pennington, 1885, Brit. Zooph., p. 182.

Epizoanthus cancrisocius:

Hertwig (not of Studer), 1888, Zool. Voy. "Challenger," Rep. Actiniaria, Suppl. lxxiii. p. 41, pl. i., fig. 15.

Polythoa incrustata:

Bourne, 1890, Journ. Marine Biol. Assoc., i., p. 319.

Form.—Thickly incrusted forms, of which the well-grown polyps are twice as high as broad. Two well-marked varieties:—A. Incrusting form, cœnenchyme forming carcinæcia by replacement of a gasteropod shell; the two primary polyps at each end of the shell, usually forming a well-marked posterior marginal row of polyps; other polyps scattered on dorsal surface; maximum number about 10–12, varying much in height; no polyps on the under surface of the carcinæcium. B. Free form, primarily consisting of two individuals base to base, each of which may divide more or less regularly, or one only may divide.

Colour.—Sandy.

Dimensions.—Polyps, 3–9 mm. in height; 1·5–4·5 mm. in average diameter. Colonies, greatest length, 22–35 mm.; greatest breadth, 13–20 mm.

Locality.—Shetlands; W. and S. W. Ireland; N. E. England; Lerwick (Barlee); 30 miles E. and N. of Brassey I., 70–80 faths. (Barlee); Haaf, Shetland, 1863 (A. M. N.); 5–8 miles E. of Balta, Shetland, 40–50 faths., July 20–23, 1867 (A. M. N.), "commensal with *Pagurus lævis*" (Pl. LVIII., figs. 1–13); also in St. Magnus Bay (A. M. N.); 40 miles S. W. of Cape Clear, Co. Cork, 80–90 faths., 1885, commensal with *Eupagurus excavatus* and *Spiropagurus lævis* (A. C. H.); Nymph Bank, Co. Cork, 50 faths., 1886 (A. C. H.); Clew Bay, 1890; 33–40 faths. off Aran, Co. Galway, 1891 (A. C. H.), (Pl. LVIII., figs. 14–22); 33–36, Donegal Bay, 1891 (A. C. H.); Scarborough (Bean, *f.* Johnston); Northumberland, "deep water" (Alder); 48° 59′ 42″ N., 10° 7′ 27″ W., 90 faths., 1889 (G. C. Bourne), associated with *E. meticulosus;* Plymouth Sound (specimens in Mus. of Marine Biol. Assoc. Laboratory).

The geographical distribution of this species is North Atlantic, extending from the east coast of N. America to N. W. Europe.

The synonymy of this species is much involved, but we think the foregoing list is sufficiently complete. We agree with Norman in rejecting Johnston's specific name, as he considered it to be a sponge; and some years later (Hist. Brit. Zooph., 2nd ed., 1847, p. 202) he quotes Couch's description of *Z. couchii*, and has "the pleasure of naming this the only European Zoanthus after its discoverer." It is therefore clear that he did not regard his own form as a Zoanthean. We are thus obliged to adopt the specific name given to this species by Düben and Koren. Holdsworth, Gosse, and others have regarded this as a variety of *E. couchii:* we think that it will be admitted from our anatomical studies that this is not the case; neither can it be associated with *E. arenaceus*, D. Ch.

Owing to the kindness of Canon Norman we have been enabled to study some authentic Norwegian specimens of this species, and find them to be identical with the Shetland and Irish forms.

Dr. Gray had no hesitation in referring some specimens from the coast of Massachusetts, collected in forty-fathom water (Proc. Zool. Soc., 1867, p. 237), to this species. Verrill, however, erected a new species for the forms dredged off the east coast of N. America. Thanks again to Canon Norman's courtesy we have examined some of Professor Verrill's specimens, and we must confess to not being able to distinguish them specifically from the European examples. It is difficult to understand why Professor Hertwig ignored these two specific names and adopted for his specimen (Challenger Sta., 49, off Nova Scotia, 85 faths.) the name of a form from the Pacific Ocean. Verrill (**1885**) says it (incrusting variety) ranges from "49–906 fathoms; abundant."

The synonymy has also been complicated on account of the occasional free habit. This variety was first named *Sidisia barleei* by Gray. Gosse, Holdsworth, and others have regarded it simply as a variety of the typically incrusting *Z. couchii.* Verrill, too, recognises a free and an incrusting variety of *E. americanus*, and also for his *E. abyssorum;* of this latter he says: "This species generally forms the carcinæcia of *Parapagurus pilosimanus*, but sometimes consists of two or three large obconic polyps arising from a grain of sand" (*l. c.* **1885**, p. 535).

Norman, however, in referring to this variety, says (**1868**, p. 319): "Taken abundantly in company with *Zoanthus incrustatus*, of which I was at one time inclined to consider it a variety; but more careful examination and dissection has convinced me that there are certain distinctions between the two, besides the fact of Sidisia being a free-living, unattached form. Whether these distinctions are specific or sexual, a careful examination of the living animal must hereafter determine." We have compared microscopically the two varieties, and find them to be essentially similar.

Incrusting Form.—Cœnenchyme incrusting gasteropod shells inhabited by hermit-crabs, the shells being rapidly absorbed and replaced by the cœnenchyme which thus forms the carcinæcium. In old specimens the polyps appear to be irregularly arranged; but on an examination of younger specimens, three series of polyps can be distinguished. In the youngest example we have seen (Pl. LVIII., fig. 14) there is only a single polyp, which is situated at the apex of a small gasteropod shell, the shell itself being entirely coated by the cœnenchyme. The second polyp arises at the oral axis, or hilum, of the shell (fig. 15). A third one usually makes its appearance above the mouth of the shell. We have seen several cases in which the apical polyp is in the act of fission (Pl. LVIII., fig. 12). These three polyps form the first series. The second series forms a marginal row which corresponds to the aboral varex of such a shell as Ranella. The third series forms an irregular row between the two former. In no specimen of the very large number we have examined is there a polyp on the under surface of the carcinæcium. The polyps bend slightly towards the oral or anterior aspect of the carcinæcium. In a contracted state the capitulum forms a flattened disc-like termination to the polyp, on which indistinct radii, usually about 18 or 20 in number, can usually be discerned. The disc-like termination is sensibly of greater diameter than the column of the polyp.

Free Form.—The earliest stage we have seen consists of two polyps base to base. These may divide by fission more or less symmetrically (Pl. LVIII., figs. 5–11), or one polyp may divide repeatedly, and the other not at all (Pl. LVIII., fig. 2–4). The variations are so great that it would be impossible to attempt to describe them all; and we would here point out that the two species of Epizoanthus we have examined which have free forms (viz. *E. incrustatus*, *E. erdmanni*) vary in such a similar manner that the variations appear to have no taxonomic value; the same also holds good for *E. abyssorum*, Verr. We have seen specimens of similar varieties of other species which have not as yet been identified; one which comes from Naples will, we believe, be found to be a free variety of *E. arenaceus*. The size of the polyps and the character of the incrustations seem to be the only external features which distinguish the free forms of these species from each other, and these are obviously insufficient.

It is worthy of notice that the capitulum of the free varieties is usually less flattened than that of the incrusting forms.

The size which the polyps may attain apparently varies with the locality; for example, the largest of the Shetland specimens are 9 mm. in height, by 4·5 mm. in diameter; the largest colony from Balta measuring 30 × 20 mm.; that from Haaf being 35 × 20 mm. In the free variety the fully grown polyps average 6–7 mm. high, and 3–3·5 mm. across; the larger colonies being 22–23 mm. long by 8–11 mm. broad. From the S. W. of Ireland, the polyps range up to 7·5 mm. high by 3·5 in diameter, the carcinæcia being 24 × 15 mm. The W. of Ireland specimens from off Aran and from Donegal Bay run a good deal smaller: the polyps average 3–6 mm. in height and 1·5–3 mm. in diameter; most of the colonies are quite small, the largest being 22 × 13 mm. The nature of the incrustations also gives them a black-gray colour. The difference in size and colour between these and more normal specimens is so marked as to constitute a distinct variety.

Verrill's original description (**1866**, p. 34) of this species (his *Epizoanthus americanus*, n. sp.) is as follows:—" This species, which is parasitic on shells, has an incrusting base, smooth and uniform on the lower side of the shell, but giving rise to from fifteen to twenty polyps on the upper side, which diverge in all directions. Polyps variable in height and size, those of the upper central portion generally half an inch in height (13 mm.) and one-eighth (3·25 mm.) in diameter; while those around the margin of the base are not more than half so large, and much crowded. Base spreading over and completely investing dead shells of Natica, Buccinum, &c., both externally and internally. The substance of the shell in every case has been entirely removed, but the form in all parts is perfectly preserved by the membranes of the polyps, while the cavity is inhabited by a species of hermit crab (*Eupagurus pubescens*). Column pillar-like, smallest in the middle, increasing gradually below, but enlarging rapidly at the summit. Walls thin, covered by a layer of closely adhering fine sand. When contracted, the summit is slightly concave; and in the medium-sized polyps has seventeen, in the largest twenty-four sulcations, radiating from the centre, which is seldom completely closed. Tentacles, forty-eight or more, short, conical.

The localities at which this species had been obtained up to that time are given by Verrill in **1882**, p. 316. The free or type-form (of *E. americanus*, Verr.) occurred at 28 stations, 28 to 487 fathoms, whereas the incrusting variety "(= *Zoanthus norvegicus*, Kor. & Dan.)" occurred at 11 stations, 69–160 fathoms. The former is by far the most abundant numerically. Later (**1885**), he gives the bathymetrical range of the free form as "26–547 fathoms; generally diffused and very abundant" (p. 534); and of the incrusting variety, "49–906 fathoms; abundant" (p. 535).

Smith and Harger (**1874**) report this species from off the coasts of New Jersey to the Gulf of St. Lawrence; the specimens with incrusted shells inhabited by *Eupagurus pubescens* came from 60–65 fathoms; while those from 430 fathoms were on stones and on hydroid stems. The figure, which is of a magnified polyp, is of no real value.

In Verrill's last Paper (**1885**, p. 60), he says it is mostly commensal with *Eupagurus politus*, Smith, and *E. kröyeri*, very common; those on grains of sand (free variety) were even more abundant. Some occurred incrusting sponges, shells, hydroids, tunicates, gorgonia, *Paramuricea grandis*, pebbles, &c. The original specimens off New Jersey, 30 fathoms, were commensal with *E. pubescens*. We think it possible that more than one species has been identified by our American colleague as *E. americanus*.

Body-wall (Pl. LIX.; fig. 2).—The incrustations in this species are numerous, and consist for the most part of coarse grains of sand, so that it is difficult to make out the structure of the body-wall from our sections. The ectoderm is continuous, and is covered by a cuticle, to which diatoms and dark granules are attached. Nematocysts, containing similar granules, are usually abundant in the ectoderm. The incrustations are embedded in the mesoglœa throughout its entire thickness, often protruding into the cœlenteron. Single cells are occasionally found enclosed in the mesoglœa; and lacunæ are sometimes found near the union of the mesenteries with the body-wall; but the mesoglœa is for the most part devoid of cell enclosures. The usual endodermal muscular layer is present, being especially well-developed in the upper part of the column. The endoderm is formed by a thin layer of columnar cells of uniform height.

Sphincter muscle.—The mesoglœal sphincter muscle is short, and consists of well-defined cavities.

Disc and Tentacles.—The disc and tentacles present the usual structure. The muscular layers appear to be feebly developed.

Œsophagus.—The shape of the œsophagus in cross-section varies in our specimens. Sometimes it is almost circular (Pl. LX., fig. 1), the groove forming a very slight depression; in other specimens the groove is fairly-well marked. The ectoderm is almost smooth, being but very slightly folded.

Mesenteries.—The arrangement of the mesenteries is macrocnemic. The imperfect mesenteries are very slightly developed, extending into the cœlenteron but little beyond the endoderm. The ectoderm of the œsophagus is reflected, and forming a series of folds along each mesentery, is continued downwards in the usual manner to form the mesenterial filaments. The mesoglœa of the mesenteries is slightly developed. The muscle-fibres form simple layers, there being no mesoglœal plaitings. The endoderm of the mesenteries is thin, resembling that of the body-wall.

Gonads.—There were no gonads in the specimens examined by us.

Var. *barleei.*—The specimens we have cut of the free variety agree very closely in their anatomy with the above account; but the sphincter muscle appears to be longer and more powerful.

Epizoanthus paguriphilus.

(Pl. LVIII., figs. 23–25; Pl. LIX., fig. 6; Pl. LX., fig. 5.)

Epizoanthus paguriphilus:

Verrill, 1882, Am. Journ. Sci. (3), XXIII., pp. 137, 316; 1883, Bull. Mus. Comp. Zool., Cambridge, Mass., XI. (1883–85), p. 61, pl. VIII., fig. 5; 1884, Am. Fish. Com. Rep. for 1882, p. 658; 1885, Am. Fish. Com. Rep. for 1883, p. 535, pl. VIII., fig. 28. Bourne, 1890, Journ. Marine Biol. Assoc., I., p. 318.

Zoanthus (Corticanthus) paguriphilus:

Andres, 1884, Le Attinie, p. 326.

Form.—Colonies always forming carcinæcia; slightly incrusted; mesoglœa very thick; one polyp on ventral surface, the remainder forming a radiating single row, the "posterior polyp" of which is the smallest.

Colour.—Brownish in spirit specimens, but bluish-gray in colour where the thin incrustation is rubbed away.

Dimensions.—Average diameter of cœnenchyme, 55 mm.; average height of polyps, 20–25 mm.; average width of polyps, 12–16 mm.; average thickness of polyps, 8–10 mm.

Locality.—W. and S. W. Ireland:—50° 29′ 26″ N., 11° 4′ W., 400 faths., July 11, 1889 (G. C. Bourne): 500 faths., 54 miles off Achill Head, Co. Mayo, July 10, 1890 (A. C. H.), (Pl. LVIII., fig. 25). The specimens figured on Pl. LVIII., figs. 23, 24, are in the British Museum; they came from 71 miles W. by S. of the Fastnet, 315 faths., and possibly also from deeper water (*cf.* Ann. Mag. Nat. Hist. (6), IV., 1889, pp. 411, 430).

The geographical distribution of this species is North Atlantic, extending from the N. E. coast of America to N. W. Europe, in deep water.

This is the largest and most striking of the species of British Zoantheæ, and is quite a recent addition to our fauna.

The polyps are in two positions, one central and inferior, the remainder marginal, divergent, and uniserial. The cœnenchyme entirely surrounds the shell on which it grows, save for the orifice through which the commensal hermit-crab emerges. The orifice is ventrally situated, and is about 5 mm. distant from the anterior border of the carcinæcium, and is from about 15–20 mm. in diameter.

Immediately behind the orifice is a polyp, which in spirit-specimens does not rise above the general surface of the cœnenchyme, and is less than 10 mm. in diameter.

The marginal polyps are prominent, and elliptical in section. At the posterior end of the carcinæcium one polyp can readily be distinguished as being markedly smaller (15 mm. in height) than the other marginal polyps; this we term the "posterior polyp." There are in the three specimens which we have examined four well-grown polyps to the left of the posterior polyp, and four, five, and six, respectively, on the right side of the carcinæcium.

There is a space of 20 mm. between the right and left polyps on the anterior convex border of the carcinæcium. Under-surface of the carcinæcium flat; upper surface irregularly convex, with the greatest prominence towards the right.

A young specimen, which one of us dredged off the W. of Ireland, and which is drawn of the natural size in Pl. LVIII., fig. 25, shows that the order of the appearance of the polyps is probably as follows:—(1) the ventral polyp; (2) the posterior polyp; (3) the right and left anterior polyps; (4) the succeeding lateral polyps, of which the most posterior are the youngest. After four pairs of marginal polyps have appeared the further production of polyps appears to be confined to the right side.

This species is always commensal with *Eupagurus pilosimanus.*

Verrill first described this species in 1882 in the following terms:—"Polyps few and very large, stout, with broad, swollen bases, arising from a very thick, smooth, lubricous, gray or mud-coloured, translucent cœnenchyme, which at first invests small univalve shells, occupied by *Parapagurus pilosimanus*, but finally grows far larger than the shell, and eventually absorbs it. Disc broad, larger than column; tentacles numerous, rather long, light orange. Breadth of colony, 2 to 3 inches; height of polyps in expansion, 1 inch or more; diameter, ·5 to ·7 of an inch" (p. 137). He further adds:—"Hitherto it has not been found elsewhere than upon the back of this particular species of crab, which, likewise, has not been found without its polyp. Of these associated creatures we took about 400 couples, at station 947, in 312 fathoms, at one haul. It had previously only been known by a few specimens taken by the Gloucester halibut fishermen, in deep water, off Nova Scotia, and by ourselves in 1880." On p. 316 of same journal (Am. Jour. Sci. (3), XXIII.) he adds:—"[Station 947, S. by W. ¾ W, 89 miles off Martha's Vineyard, sand, mud, Aug. 9, 1881; temperature 44° Fr. U. S. Fish. Com. Rep. for 1882–1884, p. 643]." "*Epizoanthus paguriphila*, Verrill, sp. nov., 252–458 faths."—and gives a list of the stations at which it was obtained.

In the Bulletin Mus. Comp. Zool. Cambridge, Mass., Verrill gives the colour as translucent bluish or purplish-gray, or grayish-brown. In fresh specimens the tentacles are pale-orange or salmon, with lighter tips, and polyps more or less of a salmon-colour. The diameter of ordinary specimens, 60–70 mm.; vertical thickness, 25–30 mm.; length of polyps, 15–20 mm.; diameter in middle, 10–12 mm.; and at base, 12–18 mm. Some specimens considerably larger than this were obtained. There are seven to twelve polyps.

Body-wall (Pl. LIX, fig. 6).—The ectoderm is not continuous, but is penetrated by strands of mesoglœa, which unite (as in *Z. coppingeri* and other species of Zoanthus and of Isaurus, and also in *G. macmurrichi*, to form a peripheral layer of mesoglœa. This peripheral layer of mesoglœa is not distinguishable from the cuticle which covers the body. A more deeply stained outer layer may often be seen, but it appears to be simply due to the shrinking of the edge of mesoglœa under the action of heat. The columnar cells of the ectoderm are closely packed, and stain deeply. They often contain dark pigment granules. Nematocysts filled with similar pigment-granules are frequently found amongst them. The few foreign particles (chiefly foraminifera and grains of sand) which incrust this species are generally found partly embedded in the ectoderm and partly in the adjacent mesoglœa. The mesoglœa is remarkably thick, being relatively much thicker than in any other species of Zoanthean examined by us. In section the mesoglœa appears to enclose numerous "cell-islets." Some of these, however, are much elongated, and might possibly be regarded as forming parts of canals. We have not been able, however, to trace any distinct canals arising from either ectoderm or endoderm; and it seems more probable that all these cell enclosures are completely surrounded by mesoglœa. The usual spindle-shaped cells drawn out into long fibres can be discerned running through the mesoglœa. The endodermal muscular layer is not very well developed; the fibres are supported on slight, rounded plaitings of mesoglœa. The endoderm consists of a single layer of columnar cells, the peripheral portion of the cells being of a deep brown colour owing to the presence of pigment-granules.

Sphincter muscle.—The single mesoglœal sphincter is not a very powerful one. No cavities are visible, the fibres being completely embedded in the substance of the mesoglœa.

Tentacles.—The ectoderm of the tentacles is thrown into transverse folds. Numerous pigment-granules are to be found amongst the usual small nematocysts, and the nuclei in the peripheral portion. The muscular layer is not well developed. The mesoglœa forms an extremely thin layer. The endoderm is also pigmented.

Disc.—The disc is very similar in structure to the tentacles.

Œsophagus.—The ectoderm of the œsophagus is thrown into numerous folds. There is a well-marked groove. The mesoglœa forms a thin layer, except in the region of the groove where it is somewhat thicker. It contains a few cell-islets.

Mesenteries.—The mesenteries have the usual macrocnemic arrangement. The reflected ectoderm of the œsophagus is attached to them in the lower part of the œsophageal region and lower down forms the filaments as in other Zoantheæ. The mesoglœa is well developed in the œsophageal region, and here, on one side of each mesentery, plaitings which support the longitudinal fibres can be distinctly seen. Plaitings on both sides of the mesentery nearer to the body-wall which support the parieto-basilar fibres are exceedingly slight. The mesoglœa is much thinner in the lower part of the body. The endoderm is very similar to that which lines the body-wall.

Gonads.—The sexes are distinct. Male gonads are present in our sections; they are very numerous, and closely packed together, almost entirely filling up the body-cavity below the œsophagus (Pl. LX., fig. 5).

Epizoanthus couchii (Johnston).

(Pl. LVIII., figs. 26–28; Pl. LIX., fig. 4; Pl. LX., fig. 3.)

Zoanthus couchii:

Johnston, 1838, in Couch, Cornish Fauna, III., p. 73, pl. XV., fig. 3 (not of Thompson, 1843, Br. Assoc. Rep., p. 284; nor of Thompson, 1844, Ann. Mag. Nat. Hist., XIII., p. 440; nor of Landsborough, 1845, *ibid.*, XV., p. 327; all of which are *Sarcodictyon catena*, cf. Johnston, 1847, *l. c.*, p. 180). Forbes, 1844, Ann. Mag. Nat. Hist., XIV., p. 415. Johnston, 1847, Brit. Zooph., ed. 2, p. 202, pl. XXV., fig. 9. Landsborough, 1852 (in part), Brit. Zooph., p. 225. Thompson, 1856, Nat. Hist. Ireland, IV., p. 462; Holdsworth, 1858 (in part), Proc. Zool. Soc., p. 557, pl. X., figs. 4–7. Wright and Greene, 1858, Brit. Assoc. Rep., p. 180. Gosse, 1860, var. *linearis*, Brit. Sea Anem., p. 297, pl. X., fig. 5. Hincks, 1861, Ann. Mag. Nat. Hist. (3), VIII., p. 363.

(*Dysidea* (?) *papillosa :*
Johnston, 1844, Hist. Brit. Sponges (in part), pp. 190, 251, pl. XVI., figs. 6, 7.

Carolia couchii :
Gray, 1867, Proc. Zool. Soc., p. 239.

Palythoa couchii :
Fischer, 1874, Nouv. Arch. Mus., Paris, pp. 235, 239; 1874, Comptes rendus, LXXIX., p. 1209 (trans. 1875, Ann. Mag. Nat. Hist. (4), XV., p. 374); 1875, Actes Soc. linn. Bordeaux, XXX., p. 8.

Polythoa arenacea :
(Not of D. Ch.) Andres, 1884, var. *couchii*, Le Attinie, p. 308; Pennington, 1885, var. *linearis*, Brit. Zooph. (in part), p. 182.

Palythoa arenacea :
(Not of D. Ch.) Carus, 1884, Prod. Faunæ Medit., p. 75.

Form.—Column cylindrical, rising to about three or four times its diameter. Margin cut into 12 or 14 (generally the latter number) large, fleshy, triangular teeth, which are connected by a thin web of transparent membrane. In a state of semicontraction these teeth form strongly marked, converging ridges on the flat summit of the column. Incrustations of fine sand. When the column is much distended, the grains of sand become considerably separated, and the visceral cavity can be seen through the transparent and smooth integuments. Disc, generally flat or slightly concave, but protusile in a conical form; radii distinct. Tentacles 28 (or 24), bicyclic, those of the inner row correspond to the marginal teeth; they are subequal, they taper gradually, are bluntly pointed, and about equal in length to the diameter of the column. Cœnenchyme, narrow, irregularly creeping, soft, invested with sand like the column.

Colour.—Column and cœnenchyme pale brown; disc pellucid, reddish-gray, dusted with excessively minute white specks; tentacles translucent, nearly colourless, opaque white tip; lip opaque white.

Dimensions.—"One-eighth of an inch [3 mm.] in diameter, and about thrice that height [9 mm.] in extension. In contraction the button is usually about a line [2 mm.] in height. Mr. Holdsworth has obtained specimens much larger than these."

Habitat.—"var. *linearis.*—The condition above described, in which the root-band creeps in a narrow ribbon over stones and shells. Cornwall and Devon."

The foregoing description is taken from Gosse, and refers to the specimens he had seen alive; perhaps he has incorporated older observations in it.

We have not been able to see any specimens of this species from the recorded localities, although we have made numerous efforts to do so. Our generous friend Canon Norman put some Zoantheæ from the Channel Islands at our disposal, which bear a very strong superficial resemblance to *E. couchii*, as defined above; unfortunately they had been dried at some time or other, although they were in spirit when we had them, and though we made sections of them we could not make any satisfactory observations.

In order to facilitate the work of future observers we abstract all the additional information about this species, which is valuable from a descriptive point of view.

Johnston (**1847**) defines the genus and species as follows:—"Zoanthus: polypes distant, united by a creeping, root-like, fleshy band. *Z. couchii:* body cylindrical; tentacula in several circles." In quoting from Couch he adds the following details:—"It is a very small species . . . of a light sandy or opaque red colour, and its surface is minutely glandular [this is an error of observation, and probably refers to the grains of quartz]. In its contracted state it is subconoidal, resembling both in shape and size a split pea. When semi-expanded it elevates itself to about twice its former height, and becomes contracted about its middle into an hour-glass form. When fully expanded the tentacula become distended and elongated to about the length of the transverse diameter of the body; and they are generally darker at their extremities than towards the base."

Holdsworth (**1858**) obtained some specimens from 10–12 fathoms off Torbay. "One group of six polypes on the inside of a valve of *Cardium rusticum* is arranged in a linear series; ... others are scattered over the surface of a flat stone, and have no perceptible connexion with one another, except in a few instances when two or three of them are united. ... The body forms a cylinder from 2 to 4 lines [about 4·5–9 mm.], by about half that in breadth, and is clothed with a dense coating of fine sand, which at the upper extremity is divided into 14 deeply-cut, marginal teeth; these cover the top of the column when the animal is closed. The tentacula are moderate in length, slightly tapering, smooth. . . . They are arranged in two rows containing 14 each, of which the inner series are rather the longer, and are placed opposite the angular prolongations of the column, those of the outer row alternating with them. ... The general colour of the disc and tentacula is a pale transparent brown, becoming opaque white around the mouth and at the tips of the arms, and all the intermediate parts are finely speckled with the same tint." The following year (**1859**) he obtained some much larger specimens from Torbay.

Hincks (**1861**) says, "Not uncommon: Salcombe Bay [Devonshire], on slate, stone, &c. (in about 12–15 fathoms)."

The following is a description of an Epizoanthus dredged by one of us in the S. W. of Ireland, and which we refer with some hesitation to this species. If *E. rubricornis* should prove to be a different species from *E. couchii*, our form will probably be found to be the same as the former, although the tentacles are of a different colour, and the habit of growth is different.

Form.—The column is elongated, tapering from above downwards; the body-wall is well incrusted, but when the sand is rubbed off, the body-wall is thin and translucent. The capitulum has about 14 ridges; these may be present or absent in preserved specimens; in the latter case their absence appears to be due to their being rubbed when in the dredge. Tentacles bicyclic, about 14 in number in each cyle, the inner being slightly the longer and more curved. Mouth linear, on a slight cone. Cœnenchyme, thin, either band-like, or forming small expansions.

Colour.—Sandy, sometimes dull, tawny-orange when alive; disc translucent buff, lips white, pale radii; tentacles translucent buff, opaque-white spot at tip.

Dimensions.—Usually about 10–14 mm. in height, and 2–3 mm. in diameter at the top of the contracted specimens, occasionally reaching a height of 18–20 mm., with a diameter of 4·5–5 mm.

Habitat.—S. W. Ireland; about 30 miles off Cape Clear (Pl. LVIII., figs. 27, 28), 80 fathoms; 40 fathoms off Glandore, Co. Cork; Berehaven, Bantry Bay, 10 fathoms (A. C. H.), (Pl. LVIII., fig. 26), [Proc. Roy. Irish Acad. (2), IV., Sci., 1886, in which Report Mr. S. O. Ridley identified this form as *Palythoa arenacea* (?), D. Ch., p. 617].

The Rev. Canon Norman has sent us specimens of an Epizoanthus from Birterbuy Bay, Co. Galway. They were unfortunately too badly preserved for us to be able to study them minutely, but at all events the sphincter muscle closely resembles that of our specimens from S. W. of Ireland, and externally they agreed fairly well with the English specimens of this species. Some very similar Channel Island specimens (identified as "*Z.*" *couchii*), which he gave us at the same time, probably belong to this species.

Fischer's (**1874**) description is as follows:—"The base of the colony is clothed with a layer of agglutinated sand, extending more or less; the polyps, irregularly disposed, have their column protected by a coating of sand; this is cylindrical and elongated when completely extended; colour cindery-gray; the superior border has 14 to 15 teeth. The tentacles, disposed in two rows, are short, whitish, and to the number of 28–30. The disc is whitish; the mouth small, transverse."

The specimens came from "Arcachon, from 20-45 brasses. The colonies were fixed on to the shell of *Chenopus pes-pelicani*, which gives lodging to a Sipunculus. Alder has identified it at Guernsey. M. Sauvage has obtained it at Boulogne on *Pecten maximus*, dredged in the channel" (p. 235). In his "bathymetrical distribution" he records this species on the oceanic coasts of France, from the Nullipore zone (28–72 metres), p. 239. The other Papers are merely abstracts.

To sum up the history of this species we may put the present state of our knowledge in this form. Johnston quotes Couch's description of the Cornish type specimens. Gosse, Holdsworth, and Hincks obtained Devonshire specimens which are probably the same as the former. Forbes identifies it as having been dredged by Mac Andrew in Loch Fine, W. Scotland, in 1844. Thompson records it as having been dredged by himself and Hyndman in 1835 and 1846, 15–20 fathoms, from Strangford Lough (N.E. Ireland). Wright and Greene copy this. It may or may not be this species. We now describe specimens from S. W. Ireland which may possibly be this species: Fischer identifies it from the N. and W. coasts of France. Andres and Pennington merely quote Gosse.

Body-wall (Pl. LIX., fig. 4).—The body-wall is extremely thin in this species. The ectoderm, where present, is continuous, and is covered by a thin cuticle. It contains occasional nematocysts. Incrustations, which consist chiefly of grains of sand, are fairly numerous. Cell-enclosures are very rare. The endoderm is very thin, and of uniform thickness. The muscular layer is rather feebly developed.

Sphincter muscle.—The single mesoglœal sphincter is well developed, although it is not so powerful as in the free variety of *E. incrustatus.* It consists of elongated cavities which are well filled with muscle-fibres, the cavities forming for the most part a single row (Pl. LX., fig. 3).

Disc and Tentacles.—The structure of the disc and tentacles is for the most part as in other species of Zoantheæ; but oval nematocysts, similar to those which are found in the ectoderm of the body-wall and of the œsophagus, are present in the ectoderm of the tentacles of more than one of the specimens which we have cut. We have not, however, found them in all our specimens.

Œsophagus.—The ectoderm of the œsophagus is thrown into folds which appear to be deeper as a rule in the short than in the longer specimens. There is a well-marked groove. Nematocysts are generally to be found in this region; but in one or two specimens we have not been able to find them. In some cases they are very abundant. Sometimes they appear to contain black pigment-granules. In other cases they are quite clear, containing a distinct, coiled thread.

Mesenteries.—The mesenteries present the usual macrocnemic arrangement. The imperfect mesenteries are fairly well-developed. The longitudinal muscles are borne upon mesoglœal plaitings which are frequently well-marked, but in some of our specimens they are much slighter than in others. Nematocysts are very abundant in the ectoderm, which forms the mesenterial filaments in the usual manner.

Gonads.—We found no gonads in any of our specimens.

[**Epizoanthus arenaceus** (D. Ch.), (not British, Mediterranean). (*Polythoa* (str. s.) *arenacea.* Andres, 1884, p. 308. Type var. *Palythoa arenacea*, Carus, 1884. p. 75.)

(Pl. LIX., fig. 7; Pl. LX., fig. 4.)

Form.—Column cylindrical. Body-wall, thick and opaque, sometimes transversely wrinkled, about 15 capitular ridges and 30 tentacles; cœnenchyme incrusting, with a tendency to form linear bands.

Colour.—Dirty sand (in spirit).

Dimensions.—Height, 7–12 mm.; diam., 3·5–4·5 mm.

The above description is taken from specimens identified at the Naples Zoological Station. It will be seen that *E. arenaceus* differs from *E. couchii*, chiefly in the great thickness of its body-wall, which gives it a very characteristic appearance (Pl. LIX., fig. 7). Our specimens were not well preserved, and we have therefore some difficulty in determining satisfactorily anatomical characters. The mesoglœal sphincter muscle differs from that of *E. couchii* in the appearance of its cavities, the muscle-fibres being arranged in a single row round the mesoglœa, leaving an empty space in the centre of the cavity (Pl. LX., fig. 4). The thickness of the body-wall can be well seen in transverse sections. Nematocysts are present in the ectoderm of the œsophagus, and in the mesenterial filaments.]

Epizoanth macintoshi, n. sp.

(Pl. LVIII., fig. 29; Pl. LIX., fig. 1.)

Form.—Short, very stout, rigid column, incrusted with foraminifera which give it a very characteristic, white, granular appearance. Upper surface of contracted column with 18 radial ridges. Cœnenchyme apparently linear, of same nature as the wall of the column.

Colour.—Grayish white.

Dimensions.—(In spirit) one polyp, 7 mm. high by 6 mm. in diameter; the other, 5 mm. high by 4·5 mm. in diameter.

Locality.—Shetlands (1871).

A small colony of three specimens of this species was kindly handed over to us by Dr. W. C. M‘Intosh, F.R.S., Professor of Zoology at St. Andrews. One of these we devoted to the microtome; the remaining specimens are in Prof. M‘Intosh's collection. We are pleased to be able to associate such a well-marked species with the distinguished Scottish Zoologist who has placed his collection of Actiniæ at our disposal.

Body-wall (Pl. LIX., fig. 1).—The ectoderm is much broken, owing to the incrustations. Where present it is continuous, and is covered by a thin cuticle. Thread cells, containing a few, almost black, pigment-granules, are occasionally to be met with amongst the columnar cells of the ectoderm. The mesoglœa is thinner relatively to the diameter of the column than in most species of Zoantheæ. The incrustations consist almost exclusively of foraminifera, which are frequently so large that a single specimen extends right across the body-wall, and is partly embedded in the ectoderm and partly in the endoderm, as well as in the mesoglœa. There are hardly any cell-enclosures in the mesoglœa. Single cells only are occasionally to be seen enclosed. The endodermal muscular layer appears to be fairly well developed. The endoderm is formed by a thin layer of columnar cells of uniform height.

Sphincter muscle.—The single mesoglœal sphincter is thick, extending right across the wall of the capitulum. The cavities in the mesoglœa are large.

Disc and Tentacles.—The nuclei of the ectoderm are diffused, and do not form a central band. The muscular layers are well developed.

Œsophagus.—The ectoderm of the œsophagus appears to be quite smooth, not being thrown into folds. The groove is well marked, and there is a slight thickening of the mesoglœa in this region.

Mesenteries.—The arrangement of the mesenteries is macrocnemic. Owing to the presence of a parasitic crustacean in the single specimen we have cut it is difficult to determine the details regarding the mesenteries. The imperfect mesenteries extend but a short way into the body-cavity. The mesoglœa is well developed, and is thrown on one side of each mesentery into distinct plaitings, which support the longitudinal muscle-fibres. The parieto-basal muscles are less well developed, and appear to extend but a short way from the body-wall.

Gonads.—We found no gonads.

Parasitic Crustacean.—It is impossible to determine the nature of the crustacean infesting our specimen, or to say whether it is a fully developed or a larval form.

[**Epizoanthus norvegicus** (Kor. & Dan.). (Not British, Norway.)

(Pl. LIX., fig. 5.)

Form.—Rather more clavate than *E. macintoshi;* cœnenchyme forming expansions, in which the polyps, in the specimens we have examined, appear to have a tendency to form linear series.

Colour.—Sandy brown (in spirit).

Dimensions.—Height, 6–12 mm.; diam., about 6 mm.

We are again indebted to our friend Canon Norman for specimens (identified by Danielssen) of this species. Outwardly it differs from *E. macintoshi* in the rather more clavate form mentioned above, and in the darker and more brownish colour. Our specimens of either species are not sufficiently numerous to lay much stress on the difference in the cœnenchyme, which in many species varies much according to the nature of the body to which the polyps are attached. Anatomically the two species can be readily distinguished. The ectoderm of the body-wall in *E. norvegicus* is very thick, and is crowded with nematocysts (Pl. LIX., fig. 5). In *E. macintoshi* the ectoderm is very thin relatively to the diameter of the column, and contains very few nematocysts (Pl. LIX., fig. 1). The incrustations in *E. norvegicus* are various, consisting of spicules, grains of sand, and foraminifera. In *E. macintoshi* they consist almost exclusively of foraminifera. The endoderm also in *E. norvegicus* is much thicker than in *E. macintoshi.* The imperfect mesenteries in *E. norvegicus* are remarkably well developed. In *E. macintoshi* they are feebly developed, extending a very short way into the body-cavity.]

Epizoanthus wrightii, n. sp.

(Pl. LVIII., figs. 30–33; Pl. LIX., fig. 3; Pl. LX., fig. 2.)

Form.—Column somewhat thick-set, body-wall incrusted but not particularly rigid, 16 capitular ridges, mouth a narrow slit, with one œsophageal groove; tentacles 32 in number, bicyclic, transversely corrugated when not fully extended. Cœnenchyme broad, flat, irregular. Polyps arise from the cœnenchyme; craspeda ejected from the mouth when irritated.

Colour.—Dirty pellucid-white or orange-pink; in both the disc is speckled with opaque white; tentacles with an opaque white tip; craspeda, white or orange-pink, according to the colour of the polyp.

Dimensions.—Height, 13 mm.; diameter of column, 8·5 mm.; diameter of disc, 13 mm.; length of tentacles, 13 mm. Average height of expanded spirit specimens, 4 mm.; average diameter of column, 3 mm. In the contracted specimens the height and diameter are about equal, or the latter may even be the greater.

Habitat.—Dalkey Sound, Dublin Bay; between tides; spreading over incrustations on the granite rocks but never actually attached to the granite itself.

We are indebted to the brothers Dixon, for these specimens, and the above description is mainly taken from an account recently published by them ("Notes on the Marine Invertebrate Fauna of Dublin," Proc. Roy. Irish Acad., ser. III., vol. ii., p. 29, 1891). They very kindly placed all their specimens at our disposal. We have the pleasure of dedicating this species to our friend Dr. E. Perceval

Wright, who is so well-known as a student of the Actinozoa, and who is always so ready to help his scientific colleagues.

Body-wall (Pl. LIX., fig. 3).—The ectoderm, where present, is continuous. It consists of numerous granular and deeply staining columnar cells, with occasional nematocysts scattered amongst them. It is protected by a thick cuticle, which does not stain but is of a dark brown colour owing to the presence of dark brown granules and of various foreign bodies. Incrustations chiefly consisting of coarse grains of sand, with a few foraminifera, are embedded in the mesoglœa, which contains very few cell-islets or other enclosures. The endoderm is formed by a rather thin layer of ordinary columnar cells. The endodermal muscular layer appears to be but slightly developed.

Sphincter muscle.—The single mesoglœal sphincter consists of several rows of simple cavities at the distal end. Proximally it is reduced to a single row of very small cavities (Pl. LX., fig. 2).

Disc and Tentacles.—There is little worthy of note in the structure of the disc or tentacles. Both ectodermal and endodermal muscular layers are well developed.

Œsophagus.—The ectoderm of the œsophagus is thrown into well-marked folds; there is a distinct groove, but little if any thickening of the mesoglœa in this region.

Mesenteries.—The mesenteries have the usual macrocnemic arrangement. The imperfect mesenteries are distinct, although they extend but a short way into the body-cavity. The reflected ectoderm forms the mesenterial filaments in the usual way. The mesoglœa is not very well developed; both parieto-basilar and longitudinal muscles form almost simple layers. The endoderm is thinner than that of the body-wall, and contains in addition to the ordinary columnar cells, small oval cells which stain a very deep carmine.

Gonads.—No gonads were present in the specimens examined by us.

PROBABLY BELONGING TO THIS GENUS.

Zoanthus rubricornis, Holdsworth.

Zoanthus rubricornis:
Holdsworth, 1861, Proc. Zool. Soc.: and Ann. Mag. Nat. Hist. (3), VII., p. 484, woodcut.
Hincks, 1861, *loc. cit.* (3), VIII., p. 364.

Polythoa (*Endeithoa*) *rubricornis:*
Andres, 1884, Le Attinie, p. 316.

Form.—An unattached group of ten polyps, each gradually tapering from above downward, incrusted with sand; marginal serrations not nearly so conspicuous as in *E. couchii.*

Colour.—Tentacles a distinct red.

Dimensions.—Largest polyp, 25 mm. in height, and about 5–6 mm. diameter at the top when contracted. (Judging from the figure, 20 mm. is the average height, and 5 mm. the capitular diameter.)

Habitat.—Plymouth Sound.

This species has apparently never been met with since its discovery; and we are unable to do more than recast Holdsworth's description. We have no doubt that this species is an Epizoanthus; and it very closely resembles in outward appearance the specimens of *E. couchii*, which one of us has dredged off S. W. Ireland, the habit of growth being the most distinguishing feature, and upon this we do not place any reliance. Should this species be found to be distinct from *E. couchii* we expect that our Irish specimens would have to follow the former.

PARAZOANTHUS, n. g.

Macrocnemic Zoantheæ, with a diffuse endodermal sphincter muscle. The body-wall is incrusted. The ectoderm is continuous. Encircling sinus as well as ectodermal canals, lacunæ, and cell-islets in the mesoglœa. Diœcious. Polyps connected by thin cœnenchyme.

This is a very well marked genus anatomically; but it is often impossible to distinguish between certain species of this genus and those of Epizoanthus on external examination only.

We have taken for our type *P. axinellæ* (Schmidt), as this form is so readily obtainable, and, thanks to the Naples Zoological Station, is to be found in most museums. Another advantage is that it is one of the easiest of the incrusted Zoantheæ to study microscopically.

Erdmann was the first to separate the macrocnemic Zoantheæ, with a diffuse endodermal sphincter, from those with a mesoglœal muscle. He rightly retained the genus Epizoanthus for the latter, but wrongly referred the former to Palythoa, of which he also took *P. axinellæ* as the type. We have elsewhere (**1891**) entered into a detailed discussion of our reasons for restoring Palythoa to its type species *P. mammillosa* (E. & S.), and we consequently have to erect the new genus defined above.

BRITISH SPECIES OF THE GENUS PARAZOANTHUS.

P. anguicoma (Norman), 1868.

P. dixoni, n. sp.

SYNOPSIS OF BRITISH SPECIES OF PARAZOANTHUS.

(EXTERNAL CHARACTERS.)

Cœnenchyme thin, band-like, or inconsiderable; capitular ridges about 18, prominent, granulated, ...	*P. anguicoma.*
Cœnenchyme thick, soft, expanded; capitular ridges about 21; not so prominent as in former, ...	*P. dixoni.*

(ANATOMICAL CHARACTERS.)

Mesenteries project only a short distance from the body-wall into the cœlenteron; endoderm of moderate thickness, uniform; incrustations numerous, .	*P. anguicoma.*
Mesenteries project a considerable distance from the body-wall into the cœlenteron; endoderm forming very thick ridges between every two mesenteries; incrustations few, ...	*P. dixoni.*

The following species is inserted for comparison with the above:—

Cœnenchyme thin, band-like or irregular expansions; capitular ridges 13–15, not very prominent, ... Mesenteries much as in *P. anguicoma;* endoderm very thin and uniform; incrustations not very numerous, chiefly spicular, ...	*P. axinellæ* (Mediterranean).

Parazoanthus axinellæ (Schmidt).

Type species.—(Not British.)

(Pl. LIX., fig. 8; Pl. LX., figs. 6, 7.)

Palythoa axinellæ:

Schmidt, 1862, Spongien des Adriatischen Meeres, p. 61, pl. VI., figs. 2, 3. Gray, 1867, Proc. Zool. Soc., p. 233. Heller, 1868, Ber. k. zool., bot., Gesellsch., Wien, p. 21. Jourdan, 1880, Ann. des. Sci. Nat. (6), X., p. 43. Müller, 1883, Morphologie Palythoa u. Zoanthus, p. 8. Carus, 1884, Prod. Faunæ Medit., p. 76.

Zoanthus axinellæ:

Koch, 1880, Morph. Jahrb., VI., p. 359, pl. XVI., figs. 1–6.

Polythoa (str. s.) *axinellæ:*

Andres, 1884, Le Attinie, p. 311, pl. X., fig. 7.

Form.—Polyps obconical, coated with foreign particles; capitular ridges, 13–15, not very distinct. Tentacles, 26–30; pointed with a very slight terminal swelling, perforated. Cœnenchyme band-like, linear, adhering to sponges; polyps usually in linear groups of three or four, sometimes solitary.

Colour.—Yellowish.

Dimensions.—Height, 7 mm.; diameter, 3 mm.; tentacles, 5–10 mm.

Habitat.—On various sponges, also on corallines and stones. Adriatic, Marseilles, Naples.

The foregoing description is compiled from the accounts given by Andres and Carus. In the specimens we have examined, as sent out by the Naples Zoological Station, we find that there is a considerable variation in the size of the polyps, some attaining a height of 13 mm., and the cœnenchyme forms an irregular expansion on which the polyps are very crowded. The following anatomical account is based upon these specimens. We leave it for others to determine whether more than one species is commonly identified as *P. axinellæ.* Koch's specimens appear to be the same as ours, so far as his description and figures go. The Adriatic specimens require re-investigation.

Body-wall (Pl. LIX., fig. 8).—The body-wall is covered with a delicate cuticle, beneath which lies a rather thin layer of continuous ectoderm. Numerous oval nematocysts, which do not stain, are generally to be found among the granular and deeply staining columnar cells of the ectoderm. Incrustations, consisting for the most part of sponge spicules, are scattered, sometimes thickly, sometimes more sparingly, through the mesoglœa. Beneath these incrustations, separated from the endoderm by a thin layer of mesoglœa, lies an encircling sinus, containing deeply staining nuclei and cell contents, as well as numerous nematocysts similar to those which are found in the ectoderm. The sinus is frequently interrupted by bars of mesoglœa of variable thickness, so that in cross section it often appears to consist of a circular series of rather narrow lacunæ. Canals frequently branch off from the sinus, and in many cases their connexion with the ectoderm can be distinctly seen. Single isolated cells are occasionally found enclosed in the mesoglœa. The endoderm forms a very thin and almost uniform layer.

Sphincter muscle.—The sphincter muscle is, as described by Erdmann, diffuse and endodermal.

Disc and Tentacles.—There is nothing worthy of special note in the structure of the disc and tentacles.

Œsophagus.—The groove is well marked, and the mesoglœa is considerably thickened in this region (Pl. LX., fig. 6).

Mesenteries.—The arrangement of the mesenteries is macrocnemic. The imperfect mesenteries are well developed, often reaching nearly half way from the body-wall to the œsophagus. The longitudinal muscles are well developed in the upper part of the mesenteries, close to the disc, the fibres being supported in this region by well developed mesoglœal plaitings. Lower down the plaitings disappear, the muscles forming an almost simple layer. Close to the disc a bundle of transverse fibres are seen on the opposite side of each mesentery to that which bears the longitudinal fibres. These seem to be the prolongations of the endodermal muscles of the disc and tentacles. The reflection of the ectoderm of the œsophagus, and its connexion with the filaments, can be well seen in this species (Pl. LX., fig. 6). The mesoglœa and the endoderm appear to be involved to some extent in the reflection also. The endoderm of the mesenteries forms, for the most part, a very thin layer, but it is much thickened in the region of the filaments (Pl. LX., fig. 7), the mesenteries in this region resembling those of *Z. macgillivrayi* (Pl. LXIV., fig. 8), but the thickening is not so marked as in that species, nor do we find here either zooxanthellæ or nematocysts.

Gonads.—In one of our specimens male gonads are present. They are surrounded by a thickened layer of endoderm (Pl. LX., fig. 7).

Parazoanthus anguicomus (Norm.).

(Pl. LVIII., figs. 34–36; Pl. LIX., figs. 11, 12.)

Zoanthus sulcatus ?:

Bowerbank, 1867, Proc. Zool. Soc., p. 351.

Zoanthus anguicoma:

Norman, 1868, "Shetland Report," Rep. Brit. Assoc., p. 319.

Polythoa (*Tæniothoa*) *anguicoma:*

Andres, 1884, Le Attinie, p. 317.

Palythoa, sp.:

Ridley, 1886, Proc. Roy. Irish Acad. (2), IV., Sci., p. 617.

Palythoa anguicoma:

Hertwig, 1888, Suppl. "Challenger" Rep., Actiniaria, p. 46, pl. I., fig. 7. Is probably not *P. anguicoma*, but an allied species, *P. hertwigi*, n. n.

Form.—Body rigid, rough; in some specimens the column has an almost warty appearance; capitular region swollen when contracted; radial ridges about 18 in number, prominent, rough. Tentacles in two cyles, of about 17 in each, very long and extensile, more than equal to diameter of disc when fully expanded; gradually attenuating to very slender points. Cœnenchyme incrusted, thin, either band-like, creeping on sponges and other objects, or forming broader expansions. The cœnenchyme is never well developed, and sometimes the polyps are isolated or in small groups. The smaller specimens, when contracted, have a button-like appearance.

Colour.—Pinkish-white (Norman); sand colour in preserved specimens.

Dimensions.—"Column, 3-5 times as high as broad" (Norman). Height of column, when fairly extended (in spirit), 13 mm.; diameter of withdrawn capitulum, 3–4 mm. In the "button" condition the height is much less, about 4–5 mm., or even less. Some West of Ireland specimens have, in spirits, a height of 15 mm., diameter of capitulum 5–6 mm., diameter of middle of column 3–4 mm.

Locality.—Shetlands, W. and S.W. Ireland. The exact localities for this species are as follows:—"Living on sponges, *Phakellia ventilabrum* and *P. robusta*, *Normania crassa*, *Oceanapia jeffreysii*, &c., in very deep water, 110-170 faths., 20–25 miles N.N.W. off Burrafirth Lighthouse" (A.M.N.), (Pl. LVIII., fig. 34); St. Magnus Bay, Shetland, 1867; "Porcupine, 1869, St. 8, 100–159 faths." [off Galway Bay, W. Ireland]. The foregoing are in Canon Norman's collection. 80 faths., 40 miles S.W. of Cape Clear, Co. Cork, 1885 (A.C.H.), (Pl. LVIII., fig. 36); 80 faths., off the Skelligs, Co. Kerry, July 13, 1886 (A.C.H.), (Pl. LVIII., fig. 35); 126 faths., off Achill, Co. Mayo, 1890 (A.C.H.).

This species is subject to considerable variation in general appearance, so much so that we at one time thought that the forms we had under review might belong to two species. This is the "squat button-like form" of Ridley (*l.c.*). There can be no doubt that this is the "*Zoanthus sulcatus* ?—dispersed in patches on the surface of *Desmacidon jeffreysii*, from Shetland," of Bowerbank. Hertwig (**1888**, Suppl. "Chall." Rept. Actiniaria, pp. 446–48) doubtfully refers a colony of "Palythoa" to this species from Inaccessible Island, Tristan d'Acunha (S. Atlantic), 60–90 faths. From Erdmann's anatomical investigations of these specimens it is certain that they belong to the genus Parazoanthus. The species is certainly very close to *P. anguicoma;* but we consider that the slight differences in the external characters, together with the "considerable hollow expansion" of the encircling sinus ("ring-canal") invariably opposite the insertion of the mesenteries, are sufficient to separate the two species, and for the latter we would propose the name of *Parazoanthus hertwigi.*

Body-wall (Pl. LIX., figs. 11, 12).—The ectoderm, where present, is continuous, and is covered by a thin cuticle. It forms a layer of variable thickness, and consists of columnar cells containing deeply staining granules, and of oval nematocysts which do not readily stain. Incrustations, consisting of sand spicules, foraminifera, &c., are fairly numerous, and are embedded both in the ectoderm and in the mesoglœa. There is a well-developed encircling sinus, which lies beneath the incrustations. It is of variable thickness, and is frequently crossed by strands of mesoglœa; but these strands are not at all so thick as those in *P. axinellæ*, and the sinus in consequence presents a much less broken appearance than in that species. Branching and anastomosing canals, very similar to those which we describe for *Z. coppingeri* (**1891**), connect the encircling sinus with the ectoderm. Nematocysts are frequently to be found in the encircling sinus.

Cell-islets and lucunæ are also often enclosed in the mesoglœa. The endoderm forms a thin layer of almost uniform thickness. The diffuse endodermal muscular layer is well developed.

Sphincter muscle.—The sphincter muscle is diffuse and endodermal, as in other species belonging to this genus. The mesoglœal plaitings are deep and well developed, but they branch very slightly.

Disc and Tentacles.—There is little worthy of special note in the structure of the disc and tentacles. The ectodermal muscles are exceedingly well developed.

Œsophagus.—The ectoderm of the œsophagus is generally thrown into folds, but these are in some cases very slight. There is generally a well-marked groove, the mesoglœa being here somewhat thickened. Occasionally cell-islets are to be found in this region.

Mesenteries.—The arrangement of the muscle is macrocnemic. The imperfect mesenteries generally extend well into the cœlenteron. The longitudinal muscles vary considerably in the degree to which they are developed, not only in individuals, but in different parts of the same individual. In some cases they form an almost simple layer, whilst in others they are supported on well-developed plaitings of the mesoglœa. The filaments are formed by the continuation of the ectoderm in the usual manner. Immediately below the œsophagus, the perfect mesenteries, bearing the filaments, extend but a short distance into the cœlenteron, leaving considerable empty space in the centre. Lower down they again increase in size, and near the base of the polyp they contain sinuses which appear to be of the same origin as the ectodermal enclosures of the body-wall.

Gonads.—There were no gonads in the specimens of this species which were examined by us.

Parazoanthus* dixoni, n. sp.

(Pl. LVIII., figs. 37, 38; Pl. LIX., figs. 9, 10; Pl. LX., figs. 8, 9.)

Form.—Body long, cylindrical, or quite short, smooth, or slightly roughened, very few incrustations. Polyps crowded, springing irregularly in all directions from an expanded, soft, thick cœnenchyme. Buds often arise from close to the bases of the older polyps. Scarcely any diminution in the length of the contracted polyps is noticeable as compared with the expanded specimens. The upper end of the contracted specimens is swollen, and has about 21 inconspicuous radial ridges. Disc with distinct radii; mouth ellipsoidal, lips prominent. Tentacles in two cycles of about 21 in each; length about the diameter of the disc.

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* We name this species in honour of our friends the brothers G. Y. and A. F. Dixon, who have done much valuable work in connexion with the Irish Actiniæ.

Colour.—Creamy white; polyps with a slight pinkish tinge.

Dimensions.—(In spirit). A. The larger specimens: height of column, 20 mm.; diameter, 4–5 mm.; diameter of disc and tentacles, 10 mm.; the cœnenchyme of one colony measured 60 mm. by 30 mm. (Pl. LVIII., fig. 37). B. Medium specimens: height of column, 16 mm.; diameter, 3 mm.; average diameter of disc and tentacles, 9 mm. C. Small variety: average height of column, 5 mm.; diameter, 4 mm. (Pl. LVIII., fig. 38).

Locality.—West of Ireland (5–8 miles W. of the Great Skellig, Co. Kerry, 70–80 faths., July 13, 1886. A. C. H.). This species was also obtained by the "Porcupine" in 1869. (No locality. Norman collection).

Body-wall (Pl. LIX., figs. 9, 10).—The ectoderm is continuous, and is covered by a thin cuticle. It forms a thick layer, consisting of very granular columnar cells, which stain deeply, and of numerous nematocysts which do not stain. The nematocysts in this species are scattered throughout the ectoderm in a fairly uniform manner. Incrustations consisting of spicules, grains of sand, and foraminifera may be found scattered at intervals through the mesoglœa, but in our specimens of the larger variety these are very rare. Beneath the incrustations lies a well-developed encircling sinus. It is frequently broken by strands of mesoglœa, and is connected with the peripheral ectoderm by numerous branching and anastomosing canals, very similar to those we find in *P. anguicoma.* The encircling sinus is connected with the endoderm by the fibrils or canalaculi of the mesoglœa, which are numerous and very distinct in our sections. The endoderm is not of uniform thickness as in *P. anguicoma,* but becomes very thick in the centre of each endocœle and ectocœle, thus forming a longitudinal ridge between every two mesenteries. The diffuse endodermal muscular layer is well developed.

Sphincter muscle (Pl. LX., fig. 8).—The diffuse endodermal sphincter is well developed, but very simple in character, the mesoglœa being raised into distinct but unbranched plaitings. In some sections some of these plaits appear to unite so as to enclose part of the muscle entirely in the mesoglœa, but we are uncertain whether this appearance is not due to the direction in which the sections are cut.

Disc and Tentacles.—There is little worthy of note in the structure of the disc and tentacles. The ectodermal muscular layer is well developed.

Œsophagus.—The ectoderm of the œsophagus is thrown into deep folds, into which the mesoglœa also enters. There is a deep, well-marked groove, and the mesoglœa is here very much thickened.

Mesenteries.—The arrangement of the mesenteries is macrocnemic. The imperfect mesenteries are well developed, and extend into the body-cavity nearly half-way between the body-wall and the œsophagus. The ectoderm of the œsophagus is connected with the filaments in the usual manner. The mesoglœa of the mesenteries is well developed in all our specimens, and is thickened as well as raised into distinct plaitings on that side of each mesentery which bears the longitudinal muscle fibres (Pl. LX., fig. 9). The parieto-basal muscles are not so well developed as the longitudinal ones; and they extend along each side of the mesenteries, but a short way into the cœlenteron; there is therefore no difficulty in distinguishing between the two sets of muscles; and the pairing of the mesenteries can be very distinctly seen in this species. The endoderm of the mesenteries is thinner than that of the body-wall. The perfect mesenteries, from the termination of the œsophagus downward, extend far into the cœlenteron, which is, in consequence, almost filled up by the mesenteries and their filaments. Transverse sections of *P. dixoni*, taken just below the œsophagus, present in consequence a very different appearance from those of *P. anguicoma* taken from the same region. In our specimens of the small variety we find well-marked sinuses in the mesoglœa of the mesenteries, extending from the cœnenchyme a short distance upward into the cœlenteron, disappearing at about the lower termination of the mesenterial filaments. These sinuses are very similar in appearance to the ectodermal sinuses of *Z. coppingeri*, but we are unable to find in them any connexion with the ectodermal canals of the body-wall, whilst in several places they appear to be distinctly connected with the endoderm. We do not find these sinuses in the mesenteries of any of those specimens of the larger variety of *P. dixoni* which we have cut.

Gonads.—We have found no gonads in our specimens of this species.

OF UNCERTAIN POSITION.

Zoanthus sulcatus, Gosse.

Zoanthus sulcatus:

Gosse, 1860, Brit. Sea Anemones, p. 303, pl. IX., fig. 7; pl. XII., fig. 2. Hincks, 1861, Ann. Mag. Nat. Hist. (3), VIII., p. 364.

Gemmaria (?) *sulcata:*

Gray, 1867, Proc. Zool. Soc., p. 238.

Palythoa sulcata:

Fischer, 1874, Nouv. Arch. Mus. Paris, pp. 236, 239; 1874, Comptes rendus, LXXIX., p. 1207 (trans. Ann. Mag. Nat. Hist. (4), XV., p. 374); 1875, Actes Soc. linn. Bordeaux, XXX., p. 8; 1887, Arch. Zool. exp. gén. (2), V., pp. 485, 487. Jourdan, 1890, Bull. Soc. Zool., XV., p. 175.

Polythoa (*Tæniothoa*) *sulcata:*

Andres, 1884, Le Attinie, p. 317. Pennington, 1885, Brit. Zooph., p. 183.

Form.—Column generally cylindrical, but versatile; upper third of extended column free from sand, and indented with twenty-two longitudinal sulci; lower portion sparsely incrusted with very fine sand. Disc saucer-shaped. Tentacles, 42, in two rows, the inner row corresponding in position to the marginal teeth, the outer intermediate; sub-equal, conical, pointed, usually radiating horizontally. Cœnenchyme band-like, often bearing three polyps abreast, loosely invested with coarse sand.

Colour.—Column dull uniform olive, each intersulcus having a blackish spot near its summit; each tooth is silvery white. Disc olive-yellow; tentacles colourless, transparent, with yellow-brown pigment granules.

Dimensions.—Column about 3 mm. high, and about 2 mm. wide.

Locality.—Torbay, on rock, between tidemarks.

Hincks (*l. c.*, p. 364) says:—"Mr. Gosse mentions a single colony of this pretty but very minute species as having occurred to him at Broadsands, near Brickham, on sandstone rock. On the opposite side of Torbay, however, and very close to Torquay, I have found it abundantly in the small basins hollowed out in the limestone. The Zoanthus forms little colonies on the floor of these miniature pools; but they may readily be passed over as tufts of some minute weed." Mr. G. Y. Dixon informs us that he has carefully hunted over the rock where Gosse obtained his original specimens, without being able to re-discover this species.

Fischer (**1874**, p. 236) describes this species as follows:—"Column covered in its superior half with very fine and agglutinated sand, uniformly brownish or olive, with 22 rays or ridges, on which one sees grains of sand arranged in vertical lines. The superior border of the column is indicated by a dentate border; the teeth are 11 in number, and their colour is white. The disc of the same colour as the column appears rayed. The tentacles to the number of 22 are arranged in two rows; the 11 tentacles of the inner row are longer than the marginal by a third or a fourth. They are conical, transparent, ornamented with some brown spots; their extremities have an opaque white colour. The yellow mouth is not prominent."

"I have found this species at the landing place of Arcachon, at the limit of low tide; it forms very numerous colonies, which have an appearance of the perforating sponges (Cliona), but their colour is more pronounced. The colony is fixed upon an expansion thickened by sand and other adherent matter. This is perforated by circular holes for the emission of the Zantheæ, which sink in and disappear when they are disturbed. M. Lafont has met with this species at Guéthary, on rocks.

"The figure given by Mr. Gosse is very bad. . . . The small size, the colour, the habitat of this species, readily distinguish it from the preceding [*E. couchii*]. When it is extended it measures 4 mm. in diameter." It occurs between tides (littoral zone), p. 239. The other Papers are merely abstracts.

Later (**1887**), Fischer gives the following French localities:—"Le Croisic, Piriac (Région armoricaine); Arcachon, Guéthary, (Région aquitanique); Zone littorale," p. 435.

Jourdan has recently (1890, p. 175) identified a form dredged by the Prince of Monaco (? either from the Bay of Biscay or off the Azores) as "*Palythoa sulcata* Gosse."

Zoanthus alderi, Gosse.

Zoanthus alderi:

Gosse, 1860, Brit. Sea Anemones, p. 305, pl. ix., fig. 8; pl. xii., fig. 5. Gray, 1867, Proc. Zool. Soc., p. 234. Pennington, 1885, Brit. Zooph., p. 183. Alder, Trans. Tyneside Nat. Field Club, v.

Zoanthus (Rhyzanthus) alderi:

Andres, 1884, Le Attinie, p. 328.

Form.—"Polyp inversely conical, the summit being two or more times as broad as the base; summit (in the button state) swelling, flat, depressed in the centre, with many (about twenty?) radiating striæ, indicating the marginal teeth. Surface smooth, without any investment of sand, but marked throughout with close-set, transverse, or annular wrinkles. Cœnenchyme narrow, smooth, irregularly branching, free from sand."

Colour.—Opaque, milk-white.

Dimensions.—Height of column about two lines (4 mm.); greatest diameter about half a line (1 mm.).

Habitat.—Northumberland; under-surface of a stone, at extreme low water, near the "Bear's Rock," Cullercoats (Alder).

This species has not been met with since its first discovery by J. Alder in 1857. Gosse says: "There were about a dozen polyps in the colony, all of the same size, which seems to be good evidence that they had attained adult dimensions." Alder adds that he has "searched for it several times without success." We cannot help regarding this as an immature form.

No representative of the genus Zoantha, as determined by anatomical investigation, is known to occur in the extra-tropical portion of the North Atlantic.

Until the anatomy of "*Z. rubricornis*," "*Z. sulcatus*," and "*Z. alderi*" is investigated it will be impossible to tell the genus, let alone the species. The same criticism applies to the identification of nearly all the Zoantheæ.

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On an Undescribed species of British Zoanthus. (Proc. Zool. Soc., 1861, p. 99; also in Ann. Mag. Nat. Hist. (3), VII., p. 484, fig.) [*Z. rubricornis*, n. sp.]

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INDEX OF GENERA AND SPECIES.

CAROLIA = **EPIZOANTHUS**, 634.
  couchii, 645.

CORTICIFERA = **PALYTHOA**.
  lutea, 631.

DYSIDEA = **EPIZOANTHUS**, 634.
  papillosa, 634, 636, 645.

ENDEITHOA (? genus).
  rubricornis, 652.

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  abyssorum, 633, 638, 639.
  americanus, 615, 632, 636, 638, 639, 640.
  arenaceus, 619, 632, 637, 639, 649.
  cancrisocius, 632, 633, 636.
  couchii, 616, 618, 619, 632, 635, 637, **644**, 645, 646, 647, 649, 653, 661.
  ——— var. linearis, 645.
  elongatus, 633.
  erdmanni, 623, 633, 635, 639.
  eupaguri, 633.
  incrustatus, 615, 616, 618, 619, 622, 627, 632, 634, 635, **636**, 639, 648.
  macintoshi, 615, 625, 633, 635, **649**, 650, 651.
  norvegicus, 614, 632, 650, 651.
  paguriphilus, 611, 614, 615, 616, 620, 622, 633, 635, **641**, 643.
  papillosus, 632, 634, 636.
  parasiticus, 633.
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  thalamophilus, 633.
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GEMMARIA, **630**.
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  macmurrichi, 614, 616, 617, 630, 643.
  mutuki, 617, 630.
  philippinensis, 630.
  rusei, 621, 626, 627, 630.
  sulcata, 660 (? genus).

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  cliftoni, 630.
  spongiosus, 630.
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  conferta, 629 (= Zoanthus confertus).
  incrustata, 636 (= Epizoanthus incrustatus).
  nymphæa, 630.
  tuberculata, 617, 621, 623 (= Isaurus tuberculatus).

MARDŒLL = **EPIZOANTHUS**.
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  arenacea, 636, 645, 649 (= Epizoanthus arenaceus).
  argus, 631.
  axinellæ, 617, 654 (Parazoanthus).
  calcaria, 631.
  caribæorum, 631.
  cinerea, 631.

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- cœsia, 631.
- cœsia ?, 619, 631.
- couchii, 645 (Epizoanthus).
- flava, 631.
- flavo-viridis, 631.
- glareola, 631.
- glutinosa, 631.
- howesii, 617, 618, 622, 623, 625, 631.
- kochii, 617, 618, 622, 623, 631.
- lutea, 631.
- mammillosa, 626, 631, 653.
- ocellata, 631.
- sulcata, 660 (? genus).
- tuberculosa, 631.
- sp., 656.

PARAZOANTHUS, **633**, 653.
- anguicoma, 615, 616, 617, 619, 621, 622, 633, 653, 654, **656**, 657, 659, 660.
- axinellæ, 611, 615, 617, 620, 622, 627, 633, 653, **654**, 655, 657.
- dichroicus, 615, 617, 619, 622, 625, 633.
- dixoni, 614, 615, 616, 617, 619, 620, 621, 622, 633, 653, 654, **658**.
- douglasi, 615, 617, 619, 624, 625, 633.
- hertwigi, 616, 633, 657.
- sp., 633.

POLYTHOA = **PALYTHOA** (pars), and **PARAZOANTHUS** (pars), 634.
- anguicoma, 656 (Parazoanthus).
- arenacea, 636, 645, 649 (= Epizoanthus arenaceus).
- axinellæ, 654 (Parazoanthus).
- incrustata, 636.
- rubricornis, 652 (? genus).
- sulcata, 660 (? genus).

RHYZANTHUS (? genus).
- alderi, 662.

SIDISIA = **EPIZOANTHUS**, 634.
- barleei, 632, 634, 636, 638.

SPHENOPUS, **632**.
- arenaceus, 632.
- marsupialis, 626, 632; var. bursiformis, 632.
- pedunculatus, 632.

SPONGIA = **EPIZOANTHUS**, 634.
- suberia, 636.

TÆNIOTHOA (? genus).
- sulcata, 660.

ZOANTHUS, **629**, 634.
- alderi, 662 (? genus).
- anguicoma, 656 (Parazoanthus).
- axinellæ, 654 (Parazoanthus).
- coppingeri, 616, 618, 621, 622, 623, 629, 643, 657, 660.
- confertus, 629.
- couchii, 636, 637, 638, 644, 646 (Epizoanthus).
- danæ (?), 616, 620, 623, 629.
- danai, 629.
- flos-marinus, 621, 622, 629.
- incrustatus, 636, 638 (Epizoanthus).
- jukesii, 616, 618, 620, 621, 623, 629.
- macgillivrayi, 618, 620, 621, 622, 623, 625, 629, 656.
- paguriphilus, 641 (Epizoanthus).
- rubricornis, 652 (? genus).
- sociatus, 621, 626, 629.
- sulcatus, 656, 657, 660 (? genus).
- sp., 623, 629.

EXPLANATION OF PLATE LVIII.

PLATE LVIII.

Fig.

1–22. *Epizoanthus incrustatus* (Düb. & Kor.), (p. 636).

1–11. Free variety from Shetland; Mus. Normani—1, simple form, with two polyps; 2–4, 5–8, 9–11, three varietal series.

12–13. Typical incrusting forms from Shetland; Mus. Normani.

14–21. Incrusting forms from Galway Bay. These are rather smaller and darker than the more usual forms. This series, starting from a single polyp, illustrates the manner in which new polyps arise.

22. Antero-posterior section of a carcinœcium, to show the position of the polyps and the absence of a ventral polyp.

All the above are drawn from spirit specimens, and are natural size.

23–25. *Epizoanthus paguriphilus*, Verr. (p. 641).

23–24. Upper and under surface of two different specimens from off S.-W. Ireland; half natural size.

25. Young specimen from W. of Ireland; natural size; *p.p.* posterior polyp.

26–28. *Epizoanthus couchii* (Johnst.), (p. 644).

26. Living specimen from Berehaven; drawn by A. C. H.

27–28. Spirit specimens from S.-W. Ireland; all natural size.

29. *Epizoanthus macintoshi*, n. sp. (p. 649).

Spirit specimen from Shetland; natural size.

30–33. *Epizoanthus wrightii*, n. sp. (p. 651).

30–32. Living specimens from Dublin Bay; drawn by Mr. G. Y. Dixon; not to scale. 32 showing larvæ swimming inside the tentacles.

33. Spirit specimen; natural size.

34–36. *Parazoanthus anguicoma* (Norm.), (p. 656).

34. Some of the original type specimens, consisting of one isolated example, and a group of four polyps on a sponge, from Shetland (the specimen has unfortunately dried up); Mus. Normani.

35. Ordinary forms from S.-W. Ireland, on the tube of a Serpula.

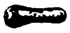
36. Button-like variety, on the tube of a Hyalonœcia; both natural size, from spirit specimens.

37–38. *Parazoanthus dixoni*, n. sp. (p. 658).

37. Group of living specimens from S.-W. Ireland; tall variety; drawn by A. C. H.

38. Short variety; spirit specimens all natural size.

[All the above specimens are in the British Museum, excepting Nos. 1–13 and 34. No. 29 was presented by Prof. W. C. M'Intosh, and No. 33 by Mr. G. Y. Dixon.]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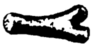
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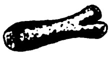
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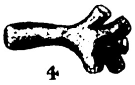
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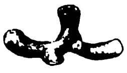
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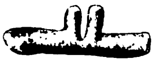
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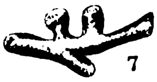
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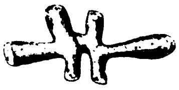
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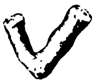
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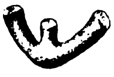
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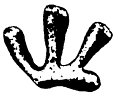
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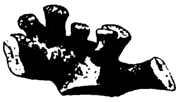
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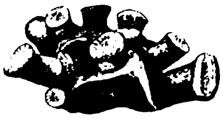
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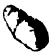
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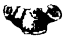
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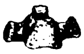
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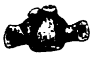
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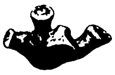
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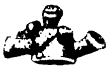
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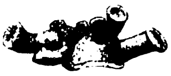
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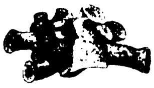
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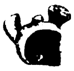
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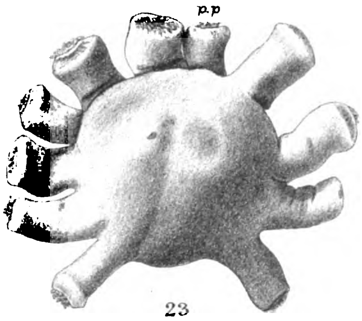

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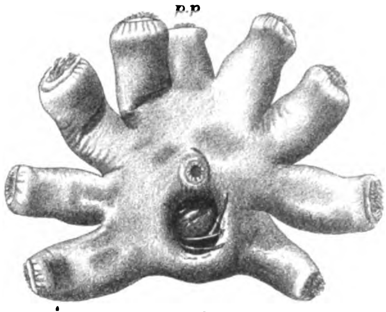

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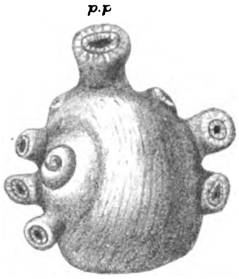

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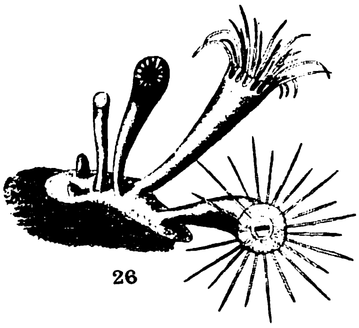
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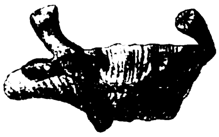
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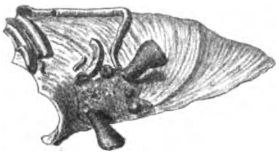
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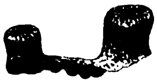
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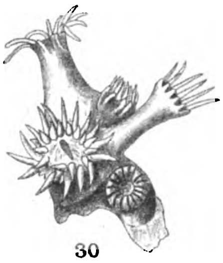
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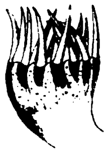
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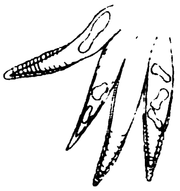
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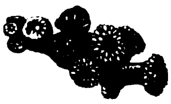
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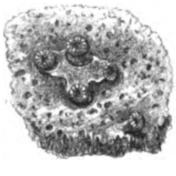
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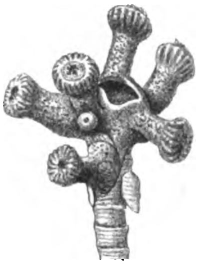
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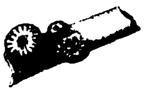
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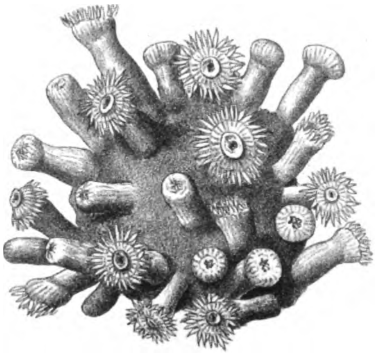
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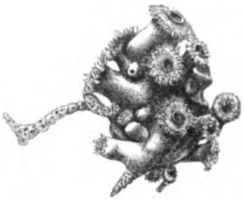
38

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EXPLANATION OF PLATE LIX.

PLATE LIX.

LETTERING ADOPTED IN THE FIGURES.

cu.,	cuticle.	*f.*,	fibrilla.
ect.,	ectoderm.	*incr.*,	incrustation.
ect. can.,	ectodermal canal.	*m.*,	mesoglœa.
enc. sin.,	encircling sinus.	*mes.*,	mesentery.
end.,	endoderm.	*nem.*,	nematocyst.
end. can.,	endodermal canal.	*p. b. m.*,	parieto-basilar muscle.

Fig.

1. *Epizoanthus macintoshi*, n. sp. (p. 649). Transverse section through the body-wall, $\frac{2}{B}$.*
2. *Epizoanthus incrustatus* (Düb. & Kor.), (p. 636). Transverse section through the body-wall, $\frac{2}{B}$.
3. *Epizoanthus wrightii*, n. sp. (p. 651). Transverse section through the body-wall, $\frac{2}{B}$.
4. *Epizoanthus couchii* (Johnst.), (p. 644). Transverse section through the body-wall, $\frac{2}{B}$.
5. *Epizoanthus norvegicus* (Kor. & Dan.), (p. 650). Transverse section through the body-wall, $\frac{2}{B}$.
6. *Epizoanthus paguriphilus*, Verr. (p. 641). Transverse section through the body-wall, $\frac{2}{A}$.
7. *Epizoanthus arenaceus* (D. Ch.), (p. 649). Transverse section through the body-wall, $\frac{2}{B}$.
8. *Parazoanthus axinellæ* (Schmidt), (p. 654). Transverse section through the body-wall, $\frac{2}{B}$.
9. *Parazoanthus dixoni*, n. sp. (p. 658). Vertical section through the body-wall, $\frac{2}{B}$.
10. *Parazoanthus dixoni*. Transverse section through the body-wall, $\frac{2}{B}$.
11. *Parazoanthus anguicoma* (Norm.), (p. 656). Transverse section through the body-wall, $\frac{2}{B}$.
12. *Parazoanthus anguicoma*. Vertical section through the body-wall, $\frac{2}{B}$.

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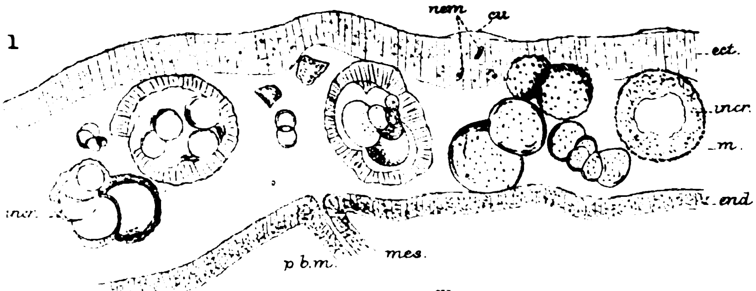
* These letters of magnification refer in all cases to Zeiss' system.

Plate LIX.

1



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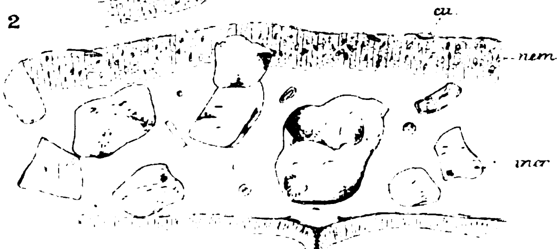

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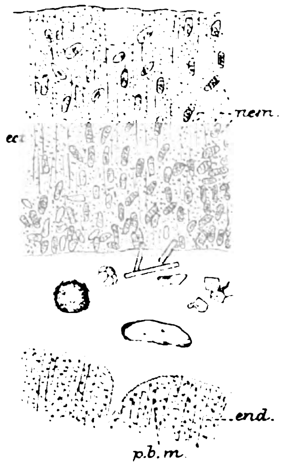

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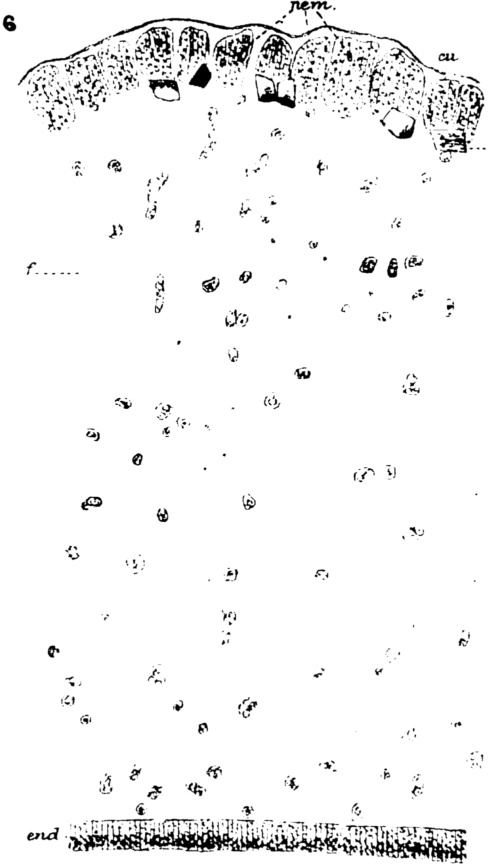

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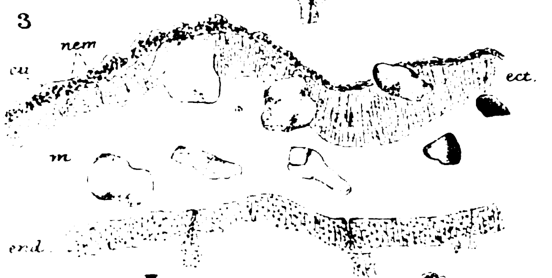

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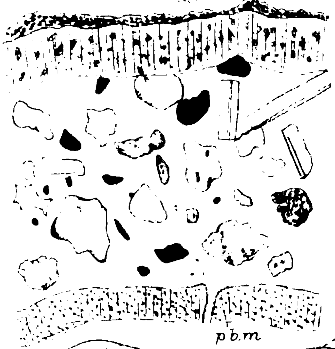

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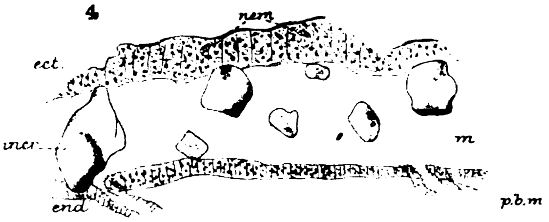

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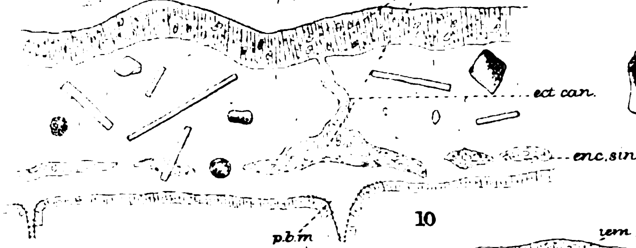

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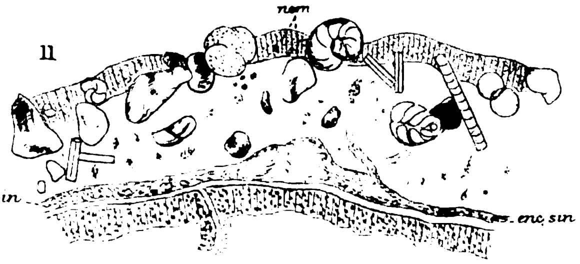

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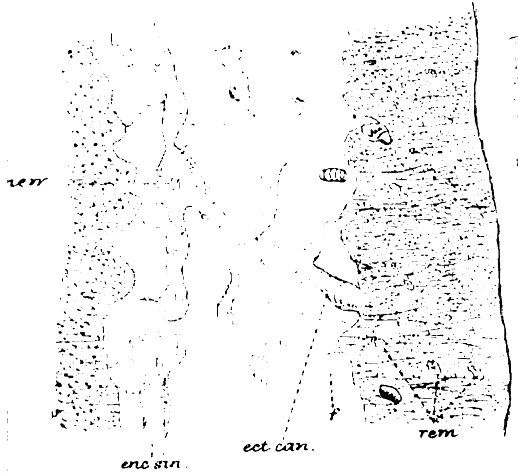

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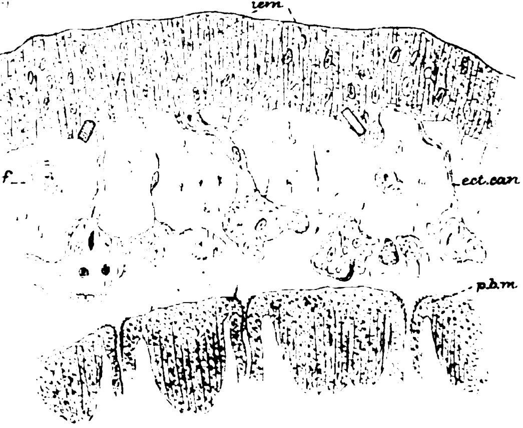

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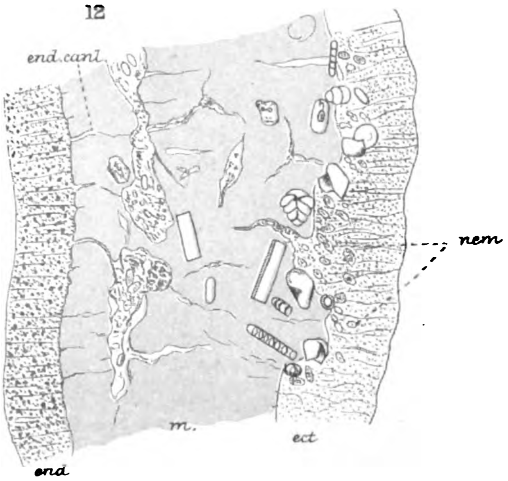

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M.P. Parker chr.lith.

West, Newman imp

EXPLANATION OF PLATE LX.

PLATE LX.

LETTERING ADOPTED IN THE FIGURES.

cu.,	cuticle.
ect.,	ectoderm.
enc. sin.,	encircling sinus.
end.,	endoderm.
end. sph. m.,	endodermal sphincter muscle.
incr.,	incrustation.
m.,	mesoglœa.
m. cn. mes.,	macrocnemic mesentery (the sulco-sulcar lateral mesentery).
m. f.,	mesenterial filament.
m. sph. m.,	mesoglœal sphincter muscle.
nem.,	nematocyst.
œs.,	œsophagus.
œs. r.,	œsophageal ridge.
p. b. m.,	parieto-basilar muscle.
r. ect.,	reflected ectoderm.
r. end.,	reflected endoderm.
r. m.,	retractor muscle.
s. d.,	sulcar directive mesenteries.
sl. d.,	sulcular directive mesenteries.
s. gr.,	sulcar groove.
sp.	sperm-cell (testis).

Fig.

1. *Epizoanthus incrustatus* (Düb. & Kor.), p. 636). Transverse section through the œsophageal region of the column, $\frac{4}{a^* \ 10}$.

2. *Epizoanthus wrightii*, n. sp. (p. 651). Vertical section through the sphincter muscle, $\frac{2}{B}$.[*]

3. *Epizoanthus couchii* (Johnst.), (p. 644). Vertical section through the sphincter muscle, $\frac{2}{B}$.

4. *Epizoanthus arenaceus* (D. Ch.), (p. 649). Vertical section through the sphincter muscle, $\frac{2}{B}$.

5. *Epizoanthus paguriphilus*, Verr. (p. 641). Transverse section through a fertile mesentery, $\frac{4}{a^* \ 10}$.

6. *Parazoanthus axinellæ* (Schmidt), (p. 654). Transverse section through the œsophageal region of the column, $\frac{4}{a^* \ 10}$.

7. *Parazoanthus axinellæ*. Transverse section through a fertile mesentery, $\frac{2}{B}$.

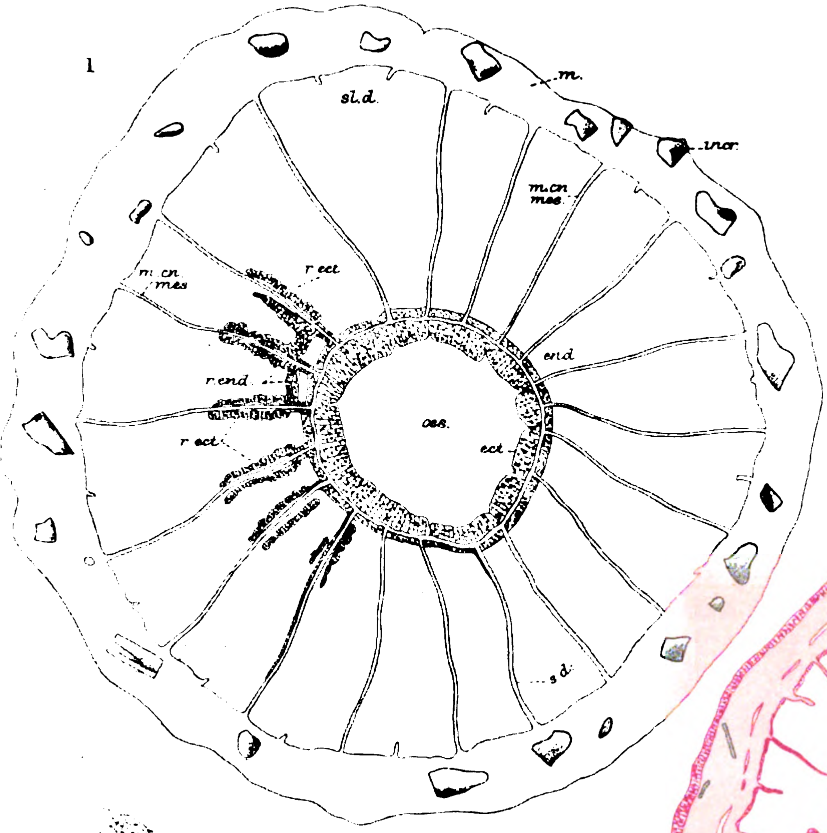
8. *Parazoanthus dixoni*, n. sp. (p. 658). Vertical section through the sphincter muscle, $\frac{2}{B}$.

9. *Parazoanthus dixoni*. Transverse section through a perfect and an imperfect mesentery, $\frac{2}{B}$.

[*] These letters of magnification refer in all cases to Zeiss' system.

Plate LX.

1



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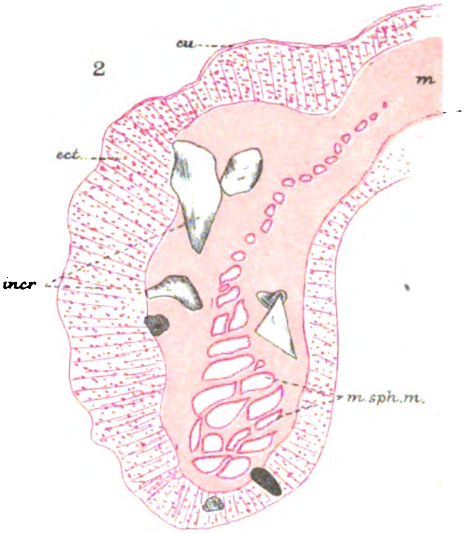

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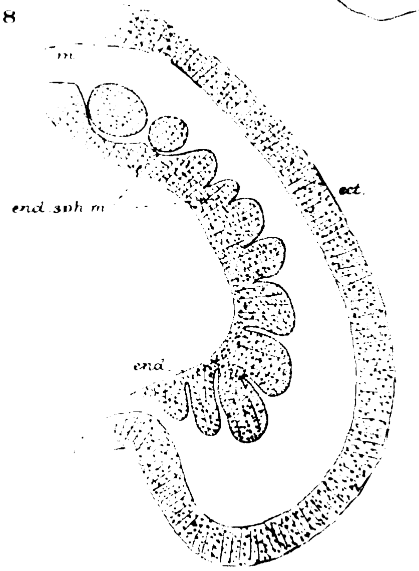

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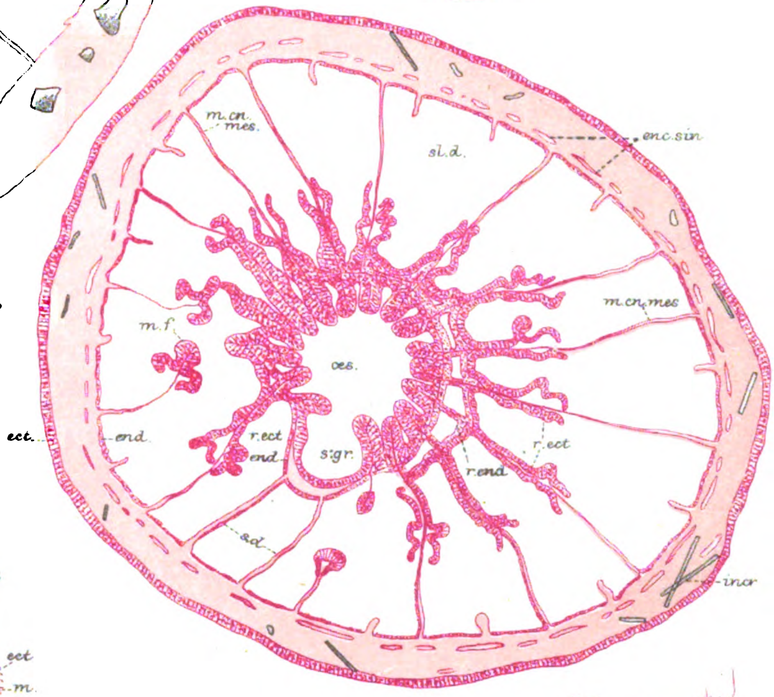

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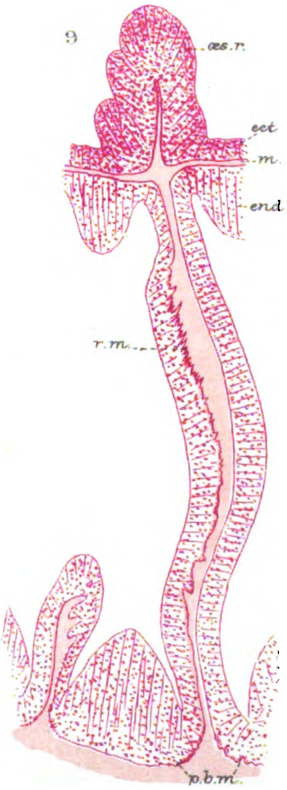

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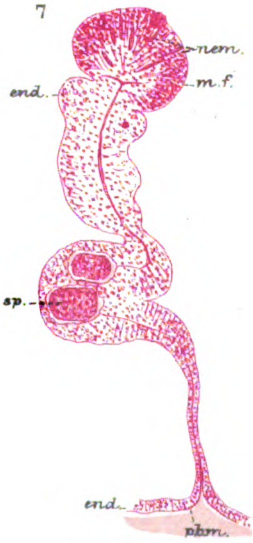

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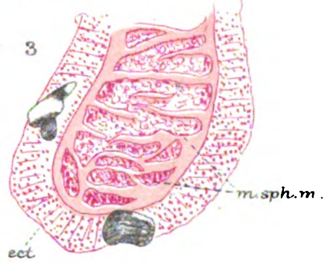

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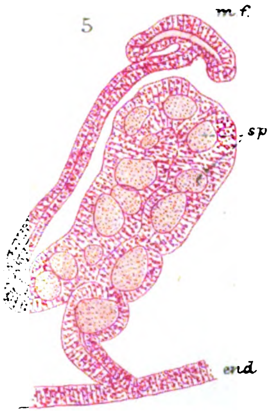

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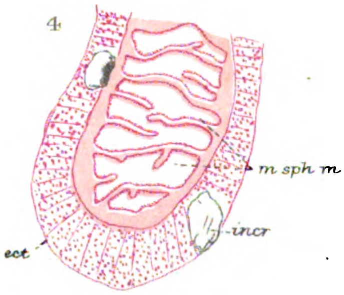

J. M. S. del ad nat.
M. P. Parker chr. lith.

West, Newman imp.

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